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SELECTED WATER RESOURCES ABSTRACTS

A Semimonthly Publication of the Water Resources Scientific Information Center, Office of Water Research and Technology, U.S. Department of the Interior

VOLUME 10, NUMBER 3
FEBRUARY 1, 1977

W77-01051 -- W77-01550

The Secretary of the U.S. Department of the Interior has determined that the publication of this periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through August 31, 1978.

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographical citation and a set of descriptors or identifiers which are listed in the **Water Resources Thesaurus.** Each abstract entry is classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

WRSIC IS NOT PRESENTLY IN A POSITION TO PROVIDE COPIES OF DOCUMENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Water Resources Scientific Information Center (WRSIC). The Center was established by the Secretary of the Interior and has been designated by the Federal Council for Science and Technology to serve the water resources community by improving the communication of water-related research results. The Center is pursuing this objective by coordinating and supplementing the existing scientific and technical information activities associated with active research and investigation program in water resources.

To provide WRSIC with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas.

Additional "centers of competence" have been established in cooperation with the Environmental Protection Agency. A directory of the Centers appears on the inside back cover.

Supplementary documentation is being secured from established discipline-oriented abstracting and indexing services. Currently an arrangement is in effect whereby the Bio-Science Information Service of Biological Abstracts supplies WRSIC with relevant references from the several subject areas of interest to our users. In addition to Biological Abstracts, references are acquired from Bioresearch Index which are without abstracts and therefore also appear abstractless in SWRA. Similar arrangements with other producers of abstracts are contemplated as planned augmentation of the information base.

The input from these Centers, and from the 51 Water Resources Research Institutes administered under the Water Resources Research Act of 1964, as well as input from the grantees and contractors of the Office of Water Research and Technology and other Federal water resource agencies with which the Center has agreements becomes the information base from which this journal is, and other information services will be, derived; these services include bibliographies, specialized indexes, literature searches, and state-of-the-art reviews.

Comments and suggestions concerning the contents and arrangements of this bulletin are welcome.

Water Resources Scientific Information Center
Office of Water Research and Technology
U.S. Department of the Interior
Washington, DC 20240

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01 NATURE OF WATER
Includes the following Groups: Properties; Aqueous Solutions and Suspensions

02 WATER CYCLE
Includes the following Groups: General; Precipitation; Snow, Ice, and Frost; Evaporation and Transpiration; Streamflow and Runoff; Groundwater; Water in Soils; Lakes; Water in Plants; Erosion and Sedimentation; Chemical Processes; Estuaries.

03 WATER SUPPLY AUGMENTATION AND CONSERVATION
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07 RESOURCES DATA
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ABSTRACT SOURCES

2. WATER CYCLE

2A. General

COMPARISON OF TWO MATHEMATICAL MODELS OF SURFACE RUNOFF,
New Mexico Inst. of Mining and Technology, Socorro.
For primary bibliographic entry see Field 2E.
W77-01334

APPLICATION OF A PARAMETRIC MODEL TO SIMULATE FLOWS FROM AN URBAN WATERSHED,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Civil Engineering.
J. A. Harris, and V. O. Shanholtz.
(1975). 35 p, 12 fig, 8 tab, 14 ref.

Descriptors: *Parametric hydrology, *Model studies, *Agricultural watersheds, *Urbanization, *Hydrology, Waste disposal, Pumping, Water supply, Calibrations, Computers, *Ohio.
Identifiers: *Standford Watershed Model, *Kentucky Watershed Model, *Ottawa River Watershed(Ohio).

Parametric watershed models, such as the Kentucky Watershed Model, have been used satisfactorily for simulating the hydrology of agricultural watersheds. With the addition of a divergent flow subrouting to account for direct waste discharges and pumpages by municipal and industrial sources, these models can be used to predict the effects of urbanization. Utilization of the percent impervious area parameter for reflecting the degree of urban influence within the watershed has been shown to be a valid approach. This method can also be used in regional planning, when information is needed concerning effects on the watershed hydrology from urban growth. Urbanization effects on the hydrologic response of the Ottawa River watershed in Ohio were investigated with the modified parametric model. (Singh-ISWS)
W77-01339

A TWO-DIMENSIONAL FLOOD ROUTING MODEL,
University of the Witwatersrand, Johannesburg (South Africa). Dept. of Civil Engineering.
For primary bibliographic entry see Field 4A.
W77-01358

DESIGN FLOOD SYNTHESIS BY EXCESS RAIN ROUTING,
University of the Witwatersrand, Johannesburg (South Africa). Hydrological Research Unit.
S. W. Bauer, and D. C. Midgley.
The Civil Engineer in South Africa, Vol 17 (8), p 199-202 (1975), Vol 15 (1), p 16, (1976). 4fig, 3 tab.

Descriptors: Hydrography, Rain gages, Rainfall-runoff relationships, *Design flood, *Synthetic hydrology, *Rainfall intensity, *Precipitation excess.
Identifiers: South Africa.

Trials of several routing procedures for hydrography synthesis revealed that routing of the excess rain hyetograph through a single linear reservoir-type storage could yield a plausible direct runoff hydrograph provided the shape and drainage pattern of the catchment was not abnormal. The method requires evaluation of only one parameter, the routing constant K, to define the hydrograph for an excess rain of given depth and duration. K values were determined for 92 South African catchments by seeking best-fits between routed and observed unitgraphs. To aid estimation of K for ungauged catchments the country was subdivided into veld-type zones for each of which a relationship between K and area of catchment is provided. A worked example demonstrates the method. (South Africa)
W77-01452

2B. Precipitation

A TECHNIQUE FOR PREDICTING THE AQUATIC ECOSYSTEM RESPONSE TO WEATHER MODIFICATION,
Utah Center for Water Resources Research, Logan.
For primary bibliographic entry see Field 3B.
W77-01051

WAVE PREDICTION FOR THE EAST COAST OF INDIA UNDER STORM CONDITIONS IN THE BAY OF BENGAL,
Karnataka Regional Engineering Coll., Suratkal (India).
For primary bibliographic entry see Field 2L.
W77-01124

A STUDY OF HOURLY RAINFALL DISTRIBUTION AROUND MONSOON DEPRESSION CENTRE IN CENTRAL INDIA,
Regional Meteorological Center, Nagpur (India).
K. S. Venkataraman, A. Chowdhury, and A. K. Banerjee.
Indian Journal of Meteorology and Geophysics, Vol. 25, No. 2, p 239-244, April 1974. 5 fig, 2 ref.

Descriptors: *Rainfall, *Rainfall disposition, *Distribution patterns, *Asia, Precipitation intensity, Precipitation(Atmospheric), Rain, Monsoons, Rainfall intensity, Data processing, Depression, Storms, Meteorology.
Identifiers: *India, *Madhya Pradesh(India).

Average distribution of rainfall around the center of monsoon depression in separate intervals of six hours in central India was presented and discussed in this paper. The following observations were made: The area around the first 100 km of the depression center is generally free from intense rainfall activities. The heavy rainfall belt is mostly confined to the left forward quadrants of the depression field, and rainfall is most widespread in these quadrants in the third and fourth six-hour intervals, reckoned with 03 GMT. Hourly intensities of rainfall greater than 50 mm/hr, however, are more frequent during the first 6-hr interval. (Sims-ISWS)
W77-01125

DIURNAL VARIATION OF RAINFALL IN BRAHMAPUTRA VALLEY,
Meteorological Office, Nasik (India).
B. Prasad.
Indian Journal of Meteorology and Geophysics, Vol. 25, No. 2, p 245-250, April 1974. 7 tab, 5 ref.

Descriptors: *Rainfall, *Rainfall disposition, *Diurnal, *Asia, Mountains, Valley, Precipitation(Atmospheric), Precipitation intensity, Rain, Rainfall intensity, Meteorology.
Identifiers: *India, *Brahmaputra Valley(India).

A study was done of the diurnal variation of rainfall at four stations within the Brahmaptura Valley. The mean hourly monthly rainfall at the four stations was considered. It was found that a well marked diurnal variation in the rainfall exists with the maximum in the early morning hours and the minimum in the afternoon hours. It was argued that this is mainly due to the mountain winds. (Sims-ISWS)
W77-01126

A STUDY OF MAXIMUM VALUES OF WITHIN-STORM RAINFALL,
Meteorological Office, New Delhi (India).
P. S. Harihara Ayyar, and N. Tripathi.
Indian Journal of Meteorology and Geophysics, Vol. 25, No. 2, p 251-255, April 1974. 1 fig, 5 tab, 2 ref.

Descriptors: *Rainfall, *Design storm, *Probable maximum precipitation, *Asia, Duration curves, Statistics, Precipitation(Atmospheric), Excessive precipitation, Rain, Precipitation intensity, Rainfall intensity, Storms, Design flood, Weather data, Climatic data, Meteorology, Climatology.
Identifiers: *India.

It has been observed by hydrologists that the maximum flood peaks are generally produced by storms of long duration containing high intensity spells, whereas only low flood peaks are produced by short duration storms though the rainfall intensity in the storms may be higher. Hence it is advisable to take the design rainfall value of the required duration and frequency computed from the within-storm rainfall values. Design engineers often require adjustment factors for converting the among-storm rainfall value to within-storm rainfall value. For this purpose, depth-transformation curves for a 2-year return period for the Indian region were compiled and presented. For return periods of 25 years and above, the adjustment factor was found to be nearly 1.0. (Sims-ISWS)
W77-01127

DYNAMICAL ABNORMALITIES ASSOCIATED WITH DROUGHT IN THE ASIATIC SUMMER MONSOON,
Institute of Tropical Meteorology, Poona (India).
R. N. Keshavamurty, and S. T. Awade.
Indian Journal of Meteorology and Geophysics, Vol. 25, No. 2, p 257-264, April 1974. 6 fig, 1 tab, 12 ref.

Descriptors: *Droughts, *Monsoons, *Asia, Circulation, Air circulation, Precipitation(Atmospheric), Rainfall, Temperature, Air temperature, Water shortage, Meteorology, Climatology.
Identifiers: *India.

In the recent past, 1965 and 1972 were years of severe drought over India. The dynamical and thermal features of those years were contrasted with the features of a normal monsoon season. The main local abnormality during drought years is the shift of the monsoon trough northwards and development of aticyclones over central India in the lower troposphere. The main abnormality in the thermal field is that temperatures are considerably below normal over southern parts of USSR, Iran, Afghanistan, and north India. Quasi-geostrophic 'omega' was used to delineate the vertical circulations. It was seen that the north-south circulation and associated energy conversion were weaker and the east-west circulation more marked during breaks. A model of the vertical circulations during drought periods was suggested. The intensity, phase, movement, and vertical and horizontal tilts of the different wave numbers in the mid-latitudes during drought and in the preceding months were contrasted with the normal conditions. In 1972, wave Nos. 5-9 were abnormally pronounced and showed some dynamical differences. (Sims-ISWS)
W77-01128

RESULT OF OPERATIONAL CLOUD SEEDING EXPERIMENT OVER RIHAND CATCHMENT IN NORTHEAST INDIA,
Institute of Tropical Meteorology, Poona (India).
For primary bibliographic entry see Field 3B.
W77-01129

THE STUDY OF DROUGHTS BY WATER BUDGET METHOD OVER ANDHRA PRADESH,
Institute of Tropical Meteorology, Poona (India).
P. Rakhecha.

Indian Journal of Meteorology and Geophysics, Vol. 25, Nos. 3 and 4, p 411-416, July and October 1974. 6 tab, 5 ref.

Descriptors: *Droughts, *Climatology, *Water balance, Hydrologic budget, Evapotranspiration, Arid climates, Arid lands, Moisture deficit, Water shortage, Climatic data, Rainfall, Precipitation(Atmospheric), Weather, Meteorology.
Identifiers: *India, *Andhra Pradesh(India)..

Studies of droughts based on water budget method seem to provide a more realistic approach than studies based on rainfall alone. The frequency and pattern of variation of the drought situations for a group of 9 stations in Andhra Pradesh during the last 70 years were studied by computing aridity indices values from water balance considerations of Thornthwaite. From this study, it was seen that a minimum of 3-4 effective drought years may be expected over each station in a decade and that liability to drought is maximum in Nellore. An examination of the year-to-year changes in climate showed that the disastrous drought years generally became arid in nature. (Sims-ISWS)
W77-01130

GENERALIZED RELATIONSHIP BETWEEN MAXIMUM RAIN DEPTH, AREA AND RETURN PERIOD FOR MAJOR RAINSTORMS,
Institute of Tropical Meteorology, Poona (India).
O. N. Dhar, and P. Rakhecha.
Indian Journal of Meteorology and Geophysics, Vol. 25, Nos. 3 and 4, p 417-422, July and October 1974. 3 fig, 3 tab, 11 ref.

Descriptors: *Depth-area-duration analysis, *Rainfall, *Probable maximum precipitation, Analytical techniques, Depth-area curves, Duration curves, Rainfall intensity, Frequency, Storms, Meteorological data, Meteorology, Climatology.
Identifiers: *Tropical storms, *India, *Bihar region(India).

A generalized relationship among maximum rain depth, area, and return period was determined using Karoly and Alexander technique. For this purpose, major rainstorms which affected Bihar region during the 65-year period from 1897 to 1961 were analyzed, and their depth-area-duration data utilized. The 3-day relationship was found to be of the form $d = -2.76 \log A \log T - 4.08 \log A + 16.03 \log T + 23.73$. Based on this relationship, a monogram was prepared with which maximum 3-day rain depths could be obtained for different areas and return periods. Conversion factors were also worked out for obtaining maximum rain depths for one and two-day durations for different areas and return periods. (Sims-ISWS)
W77-01131

THE RESULTANT DIRECTION AND INCLINATION OF RAINFALL AT TAITA EXPERIMENTAL STATION, NEW ZEALAND,
Department of Scientific and Industrial Research, Lower Hutt (New Zealand). Soil Bureau.
R. Aldridge.
Journal of Hydrology (New Zealand), Vol. 14, No. 1, p 42-54, 1975. 10 fig, 1 tab, 11 ref.

Descriptors: *Rainfall, *Precipitation(Atmospheric), Winds, Data processing, Measurement, On-site investigations, Data collections, Monthly, Seasonal, Annual, *Rain gages.
Identifiers: *New Zealand, Vectopluviometers, Inclined rainfall, Rainfall direction.

Resultant direction and inclination of rainfall at Taita Experimental Station, Lower Hutt, New Zealand, have been computed from vectopluviometer data for the period March 1959 to December 1971. The patterns of distribution of resultant direction and inclination were described in relation to selected daily-rainfall size classes. The relationship between resultant direction and inclination of daily rainfall was related to daily and monthly windrun data. Monthly, seasonal, and annual variations of resultant direction and inclinations were described. Resultant directions of rainfall over long periods showed peaks between 200 deg and 280 deg and between 320 deg and 020 deg with the largest peak, between 200 deg and 240 deg, corresponding approximately to the orientation of the lower Hutt Valley. About 40% of the daily rainfall fell at inclinations less than 11 deg from the vertical, and about 60% at less than 21 deg. Low or high inclination of rainfall may broadly be associated with low or high windrun. Northerly and westerly exposures received the largest proportion of the rainfall, and easterly exposures the smallest. Generally, spring and summer months had the largest northerly rainfall components, and autumn the largest southerly and westerly components. Winter had the largest easterly rainfall component while retaining a large southerly component. (Sims-ISWS)
W77-01133

THE RESULTANT DIRECTION AND INCLINATION OF RAINFALL AT ARAHURA, WAIRARAPA, NEW ZEALAND,
Department of Scientific and Industrial Research, Lower Hutt (New Zealand). Soil Bureau.
R. Aldridge.
Journal of Hydrology (New Zealand), Vol. 14, No. 1, p 55-63, 1975. 7 fig, 1 tab, 5 ref.

Descriptors: *Rainfall, *Precipitation(Atmospheric), *Rain gages, Winds, Data processing, Measurement, On-site investigations, Data collections, Monthly, Seasonal, Distribution, Rainfall disposition.
Identifiers: *New Zealand, Vectopluviometers, Inclined rainfall, Rainfall direction.

Resultant directions and inclinations of rainfall have been computed from vectopluviometer data taken at Arahura near Gladstone in the Wairarapa, for the period June 1967 to July 1971. The distribution of resultant direction and inclination of the daily rainfall was discussed along with the relationship between resultant direction and inclination. Monthly and seasonal variations of the resultant direction and inclination of the rainfall were presented. This study illustrated the marked predominance of southerly rainfall in this part of the Wairarapa and the rarity of northerly or westerly rainfall. Resultant inclinations of the rainfall showed that the southerly rainfall is more steeply inclined from the vertical than rainfall from other directions. (Sims-ISWS)
W77-01134

A CLIMATONOMIC STUDY OF THE LAKE ONTARIO DRAINAGE BASIN,
California Univ., Berkeley, Dept. of Geography.
For primary bibliographic entry see Field 2H.
W77-01146

DRAFT ENVIRONMENTAL STATEMENT: PROJECT SKYWATER A PROGRAM OF RESEARCH IN PRECIPITATION MANAGEMENT, VOLUME I OF II.
Bureau of Reclamation, Washington, D.C.
For primary bibliographic entry see Field 6G.
W77-01187

IFYGL RAWINSONDE DATA ACQUISITION SYSTEM,
National Oceanic and Atmospheric Administration, Ann Arbor, Mich. Great Lakes Environmental Research Lab.
For primary bibliographic entry see Field 2H.
W77-01189

ORGANIC MATTER IN ATMOSPHERIC PRECIPITATION IN THE VORONEZH REGION, (IN RUSSIAN),
Voronezhskii Lesotekhnicheskii Institut (USSR).
For primary bibliographic entry see Field 5B.
W77-01249

PROGRESS IN THE EXPLORATION AND IN THE SCIENTIFIC RESEARCH OF THE LIBYAN DESERT SINCE GERHARD ROHLFS,
Stuttgart Univ. (West Germany).
For primary bibliographic entry see Field 4A.
W77-01269

THE INTERPRETATION OF RAINFALL PATTERNS IN NORTHERN YUCATAN UTILIZING METEOROLOGICAL SATELLITE IMAGERY,
University of South Alabama, Mobile.
A. Williams.
Association of American Geographers, Proceedings, Vol 8, p 15-19, 1976. 4 fig, 7 ref.

Descriptors: *Rainfall, *Meteorological data, *Thunderstorms, *Sea breezes, *Precipitation(Atmospheric), *Satellites(Artificial), Data collections, Topography, Karst, Air masses, Orography, Climatic data, *Mexico.
Identifiers: *Yucatan Peninsula(Mexico).

The relationship between the thunderstorm anomalous rainfall pattern of the Karst Plain of the Yucatan Peninsula and the use of weather satellite imagery to assist in establishing this relationship are discussed. Conventional climatological data for Yucatan are inadequate. Thus, satellite imagery is utilized. The maximum rainfall anomaly of the northeast Karst Plain results from the convergence of two sea breezes, one from the Gulf of Mexico, one from the Caribbean. This 'double sea breeze effect' creates an area of intense convergence and the subsequent development of numerous thunderstorms resulting in 40 inches or more of rainfall a year. Without the assistance of satellite imagery, the documentation of this event would have been possible only with extensive surface instrumentation. The northwest coast of Yucatan is more arid than the eastern portion, averaging from 15 to 30 inches of rainfall per year. The entire peninsula shares a dry winter, thus summer atmospheric circulation accounts for the difference. The conclusion is that a single sea breeze inhibits thunderstorm development along the northwest coast and therefore contributes to a semi-arid climate. (Jamail-Arizona)
W77-01280

RAINFALL AND FLOODS IN INDIA DURING 1973 SOUTHWEST MONSOON PERIOD,
Meteorological Office, New Delhi (India).
S. D. S. Abbi, M. R. Nagasubramanian, and B. C. Jain.
Indian Journal of Meteorology and Geophysics, Vol. 25, Nos. 3 and 4, p 363-370, July and October 1974. 2 fig, 3 tab.

Descriptors: *Rainfall, *Climatic data, *Monsoons, Precipitation excess, Floods, Weather data, Meteorological data, Precipitation(Atmospheric), Depth-area curves, Rainfall intensity, Excessive precipitation, Isohyets, Climatology, Meteorology.
Identifiers: *India.

Rainfall during the 1973 southwest monsoon period was more or less normal over the country. It was in excess in Punjab, Jammu and Kashmir, Rajasthan, west Madhya Pradesh, and Gujarat Region. Rainfall was deficient only over coastal Andhra Pradesh where it was -27%. The characteristic feature of the 1973 monsoon period was the occurrence of excessive rainfall in west Rajasthan and west Madhya Pradesh in August, leading to serious floods. The percentage departures of the southwest monsoon rainfall week-by-week in the

35 meteorological subdivision of India were given. The progress of the monsoon from 1 June depicting the percentage departures from normal of the cumulative rainfall for the successive weeks was tabulated. Also, the salient features of the rainfall distribution were presented. (Sims-ISWS)
W77-01329

COMMENTS ON THE STORAGE OF WATER VAPOUR IN THE ATMOSPHERE OVER SOUTH AFRICA,
Natal Univ., Pietermaritzburg (South Africa).
O. S. McGee.
Water SA., Vol 1(1), p 30-35, (1975). 5 fig, 3 tab, 15 ref.

Descriptors: *Water storage, Meteorology, Rainfall, *Water vapor, Precipitation(Atmosplheric), Climate data, *Atmosphere, Africa.
Identifiers: *South Africa.

Mean monthly values of precipitable water vapour and mean daily rainfall data for each month over a two-year period at six stations (and at one locality for a five-year period) are examined to determine the space and time patterns of atmospheric water vapour storage over South Africa. From the results it may be inferred that precipitation is related more to the field of convergence of atmospheric water vapour than to the water vapour content per se and that the moisture content of the atmosphere cannot as yet be harnessed as an auxiliary source of water supply (South Africa)
W77-01365

DESIGN FLOOD SYNTHESIS BY EXCESS RAIN ROUTING,
University of the Witwatersrand, Johannesburg (South Africa). Hydrological Research Unit.
For primary bibliographic entry see Field 2A.
W77-01452

2C. Snow, Ice, and Frost

ORGANIC MATTER IN ATMOSPHERIC PRECIPITATION IN THE VORONEZH REGION, (IN RUSSIAN),
Voronezhskii Lesotekhnicheskii Institut (USSR).
For primary bibliographic entry see Field 5B.
W77-01249

ANOMALOUS LOCAL GLACIER ACTIVITY, BAFFIN ISLAND, CANADA: PALEOCLIMATIC IMPLICATIONS,
Colorado Univ., Boulder. Inst. of Arctic and Alpine Research.
G. H. Miller.
Geology, Vol. 4, No. 8, p 502-504, August 1976. 2 fig, 14 ref. NSF GA-41562.

Descriptors: *Glaciers, *Paleoclimatology, *Canada, *Arctic, Dating, Radioactive dating, Climatology, Glacial sediments, Ice, Cirques, Glacial drift, Precipitation(Atmospheric), Glaciology.
Identifiers: *Baffin Island(Canada).

Some local cirque glaciers on eastern Baffin Island were more extensive during the 'Little Ice Age' than at any time in at least the past 34,000 yr and possibly the past 60,000 yr. The most reasonable paleoclimatic explanation of such anomalous glacier activity is that during the last glacial maximum in southern Canada, Arctic regions experienced diminished precipitation. (Sims-ISWS)
W77-01333

SNOWMELT LYSIMETERS PERFORM WELL IN COLD TEMPERATURES IN CENTRAL COLORADO,
Forest Service (USDA), Fort Collins, Colo. Rocky Mountain Forest and Range Experiment Station.
R. W. Schultz.
Research Note RM-247, September 1973, 8 p, 8 fig, 9 ref.

Descriptors: *Lysimeters, Snow management, *Snowmelt, *Colorado, Temperature, Measurement, Instrumentation.

Comparison between lysimeter and snow-tube measurements of melt rates indicated that the lysimeters provided reliable measurements of snowmelt. The lysimeter frame did not noticeably affect the thermal regime of the snow within the lysimeter. (Forest Service)
W77-01432

2D. Evaporation and Transpiration

THE STUDY OF DROUGHTS BY WATER BUDGET METHOD OVER ANDHRA PRADESH,
Institute of Tropical Meteorology, Poona (India).
For primary bibliographic entry see Field 2B.
W77-01130

A CLIMATONOMIC STUDY OF THE LAKE ONTARIO DRAINAGE BASIN,
California Univ., Berkeley, Dept. of Geography.
For primary bibliographic entry see Field 2H.
W77-01146

THE MEASUREMENT OF WATER LOSSES FROM A FORESTED AREA USING A 'NATURAL' LYSIMETER,
Institute of Hydrology, Wallingford (England).
I. R. Calder.
Journal of Hydrology, Vol. 30, No. 4, p 311-325, 1976. 7 fig, 2 tab, 12 ref.

Descriptors: *Lysimeters, *Water loss, *Forests, *Evaporation, Interception, Transpiration, Forest management, Runoff, Water balance, Soil moisture, Rainfall, On-site investigations.
Identifiers: *Natural lysimeter, *Forested area, *Wales, *Potential evaporation, *Forest canopy, *Upper Severn River, Catchment, Field measurement, Water balance equation.

Water losses due to transpiration and evaporation of intercepted water were measured using a 'natural' lysimeter in the Hafren forest of central Wales. Then, they were compared with estimates of potential evaporation calculated from meteorological observations. Given certain assumptions concerning the forest canopy, the lysimeter observations were used to estimate runoff from the experimental catchment of the Upper Severn, within which the lysimeter was sited. This estimate agreed well with the observation. The annual loss recorded at the lysimeter, amounting to twice Penman E sub o, demonstrated the magnitude of the evaporation losses that arise from forests in a high-rainfall area. The total losses estimated for the Severn experimental catchment as a whole were significantly less, owing to the relatively small percentage of the total catchment area with canopy coverage and the consequent reduction in the interception loss. Interception was a major loss component in this high-rainfall area and underlined the need for accurate methods of measuring and predicting interception losses from similar areas. (Roberts-ISWS)
W77-01148

WATER SALVAGE POTENTIALS IN UTAH, VOLUME II, EVAPORATION SUPPRESSION BY RESERVOIR DESTRATIFICATION,
Utah Water Research Lab., Logan.
T. C. Hughes, E. A. Richardson, and J. A. Franckiewicz.
Report No. PRWA22-2, June 1975. 84 p, 21 fig, 16 tab, 32 ref, 9 append.

Descriptors: *Water quality control, *Evaporation, *Reservoirs, *Destratification, *Temperature, Cooling, *Utah, Regression analysis, Costs, Estimating, Environment, Benefits, Hypolimnion, Conservation, River basins, Research, Mixing, Mathematical models, Systems analysis, Forecasting.
Identifiers: *Suppression model, Mechanical pumping, Compressed air, *Water salvage.

A model is developed for predicting evaporation suppression due to the surface cooling effect of reservoir destratification. The model is based upon measured temperature profiles at a sample of ten Utah reservoirs. Regression analysis is then used to extend the results to all other deep reservoirs in Utah. Both suppression amounts and costs are estimated for each reservoir. The use of thermal mixing by either mechanical pumping or compressed air appears to have important potential for evaporation suppression on deep reservoirs. This concept does not involve many of the problems associated with monolayer suppression. It is independent of wind; it does not produce a concentration of excess heat near the surface; it provides a mechanism for net suppression on an annual rather than only a seasonal basis (warmed outflow); and it does not involve environmental problems associated with adding chemicals to the reservoir surface. There are, in fact, several environmental benefits claimed for the destratification procedure. Significant improvement in dissolved oxygen (DO), taste and odor, algae production, and many other quality parameters occur in the hypolimnion water. In addition to these human related benefits, fish habitat may be improved both in the reservoir (because of increased DO) and downstream from it. A major potential for water conservation in general and water energy production and salinity control in particular exists at Lake Powell. (Bell-Cornell)
W77-01164

EVAPORATION MEASUREMENTS WITH A SELF-RECORDING EVAPORIGRAPH,
Meteorological Office, Poona (India).
S. K. Shaha, P. S. Batar, and R. R. Kelkar.
Indian Journal of Meteorology and Geophysics, Vol. 25, Nos. 3 and 4, July and October 1974. 5 fig, 1 tab, 3 ref.

Descriptors: *Evaporation, *Evaporimeters, *Measurement, *Statistics, Evaporation pans, Water loss, On-site investigations, Diurnal, Instrumentation, Rates, Data processing, Climatology.
Identifiers: *India, *Evaporigraph.

Data collected over five years (1967-71) with a self-recording evaporigraph at the Central Agricultural Meteorological Observatory in Poona, were analyzed and discussed. The afternoon three-hour period 1330-1630 IST was found to contribute as much as 24 to 30% of the total daily evaporation recorded in any month; whereas the fifteen-hour period 1930-1030 IST accounted for only 26 to 41% of the total daily evaporation. A statistical analysis of evaporigraph data in comparison with Class A Pan evaporimeter measurements was also presented. (Sims-ISWS)
W77-01331

AN EVAPORATION EQUATION FOR AN OPEN BODY OF WATER EXPOSED TO THE ATMOSPHERE,
Auburn Univ., Ala. Dept. of Mechanical Engineering.
J. S. Goodling, B. L. Sill, and W. J. McCabe.
Water Resources Bulletin, Vol. 12, No. 4, p 843-853, August 1976. 3 fig, 10 ref.

Descriptors: *Evaporation, *Forced drying, *Wind velocity, Temperature, Air, Heat flow, Winds, Mass transfer, Equations, Air temperature, Numerical analysis, Mathematical studies.
Identifiers: *Natural evaporation, *Forced evaporation, Evaporation equation, Evaporative heat flux, Lake stratification, Cooling ponds, Mass transport.

Evaporation was identified as having two additive components: natural evaporation in the absence of wind, and forced evaporation in the presence of wind. An evaporation equation was obtained for an open body of water exposed at the atmosphere by conversion of standard, horizontal flat plate heat transfer relationships to a mass transfer or evaporation equation, based on an average air temperature of 68F. A comparison of numerical values predicted by this equation was made with evaporation equations deduced from field measurements, and the agreement was favorable. The major differences between this equation and those previously developed were: (1) This equation was derived strictly from standard heat transfer expressions, and (2) A dependency of average fetch and air temperature (through transport properties) was shown. This approach established the correct dependencies of the field parameters so that future experimental measurements would have a sound theoretical basis. (Roberts-ISWS)
W77-01338

LEAF DIFFUSION RESISTANCE TO WATER VAPOUR AND ITS DIRECT MEASUREMENT,
Agricultural Univ., Wageningen (Netherlands). Lab. of Physiological Meteorology.
C. J. Stigter, J. Birnie, and B. Lammers.
Meded Landbouwhogesch Wageningen. 73(15), p 1-55, 1973.

Descriptors: *Leaves, *Drought resistance, *Instrumentation, *Measurement, *Evaporimeters, Water vapor.
Identifiers: *Porometer resistance.

The design and calibration of an improved leaf diffusion resistance meter is described. A value for porometer resistance was derived theoretically from geometrical considerations and transport phenomena which was in good agreement with measured values. An accurate measuring procedure was designed using accurate digital indication of charges in sensor resistance. Three fixed electrical resistance values were used to obtain a short and long transient time, the ratio of the 2 making it possible to collect information on the possible influence of the measuring device on the state of opening of the stomata. (See also W73-10703)--Copyright 1975, Biological Abstracts, Inc.
W77-01378

ALLOCATION OF WATER TO FORESTRY AND OTHER USERS IN THE CATCHMENT OF THE EERSTE RIVER,
Jonkershoek Forest Research Station, Stellenbosch (South Africa).
For primary bibliographic entry see Field 4D.
W77-01385

CATCHMENT RESEARCH AT ZACHARIASHOEK,
Jonkershoek Forest Research Station, Stellenbosch (South Africa).
For primary bibliographic entry see Field 4D.
W77-01386

SIMULATION OF EVAPOTRANSPIRATION AND DRAINAGE FROM MATURE AND CLEAR-CUT DECIDUOUS FORESTS AND YOUNG PINE PLANTATION,
Forest Service (USDA), Franklin, N.C. Coweeta Hydrologic Lab.
L. W. Swift, Jr, W. T. Swank, J. B. Mankin, R. J. Luxmoore, and R. A. Goldstein.
Water Resources Research, Vol 11, No 5, p 667-673, October 1975. 3 fig, 7 tab, 23 ref.

Descriptors: *Model studies, *Simulation analysis, *Evapotranspiration, *Forest management, *Water yield, Water yield improvement, Transpiration, Interception, Soil-water-plant relationships, Soil moisture, Soil water, Clear-cutting, Reforestation, Vegetation regrowth, Watershed management, North Carolina, Tennessee, Drainage.

Prosper, a phenomenological model of water exchange between soil, plant, and atmosphere, was used to simulate evapotranspiration and annual drainage for 2 years from a mature oak-hickory forest in the southern Appalachians. The simulation was tested by comparing drainage to measured streamflow. In a year of unusually high precipitation the simulated annual drainage was within 1.5% of measured streamflow. Simulations were also performed by using the same 2 years of meteorologic data, but vegetation parameters were changed to represent a young white pine plantation and a regrowing hardwood forest 1 year after clear-cutting. The model estimated that drainage for an average rainfall year was reduced 20 cm by a 16-year-old white pine plantation and increased 36 cm by clear-cutting. These results were comparable to changes of -20 and +38 cm observed in watershed experiments at Coweeta Hydrologic Laboratory. Simulated evapotranspiration during the summer was nearly identical for hardwood and pine forests, while winter and early spring water loss was greater for pine. Simulation suggests that the greater evapotranspiration by pine was due to increased interception in all seasons and increased transpiration in the dormant season. For the clear-cut area, simulated evapotranspiration was considerably less than it was for the pine or hardwood forest and thus caused simulated soil moisture contents to be greater during the summer season. (Forest Service)
W77-01424

MULCH AND MICROCLIMATE: THE SIGNIFICANCE OF MULCH AND THE CHANGE IN TEMPERATURE BEHAVIOR RESULTING FROM IT, (IN DUTCH),
Agricultural Univ., Wageningen (Netherlands). Lab. of Physics and Meteorology.
For primary bibliographic entry see Field 2G.
W77-01447

RESULTS OF THE MULTIPLE CATCHMENT EXPERIMENTS AT THE JONKERSHOEK RESEARCH STATION, SOUTH AFRICA. 2. INFLUENCE OF PROTECTION OF FYNBOS ON STREAM DISCHARGE IN LANGRIVIER,
Jonkershoek Forest Research Station, Stellenbosch (South Africa).
For primary bibliographic entry see Field 4D.
W77-01474

2E. Streamflow and Runoff

A REVISED REGIONAL FREQUENCY CURVE FOR THE YARRA CATCHMENT ABOVE WARRANDYTE (AUSTRALIA).
Melbourne and Metropolitan Board of Works (Australia), Water supply, Sewerage and Drainage Branch.
For primary bibliographic entry see Field 4A.
W77-01068

THE MERRI CREEK FLOOD, 15-16 MAY 1974; CITIES OF NORTHCOTE BRUNSWICK (AUSTRALIA),
Melbourne and Metropolitan Board of Works (Australia). Main Drainage Div.
C. T. Earl.
Melbourne, 1974. 42 p, 3 tab, append.

Descriptors: *Flood damage, *Flood plains, *Legal aspects, *Historic floods, *Australia, Flood peak, Flood data, Flood control, Suburban areas, Urban drainage, Riparian land, City planning.
Identifiers: *Merri Creek(Vic), Melbourne(Vic).

The Merri Creek, Victoria, Australia, is a major tributary of the Yarra River, draining a catchment of 153 square miles of rural and urban lands. The flood described was of at least equal magnitude to the highest recorded since the commencement of records in 1891, and severely affected several hundred properties in suburban Melbourne. The report includes details of associated catchment rainfall, peak levels of flooding and the time of travel of the peak. The history of development of the flood plain is traced, and it is shown that not only contemporary statutes relating to flood plain subdivision, but also some fundamental tenets of the relevant Common Law, have at times been ignored. Attention is drawn to the potential effect of developments currently planned for the area (particularly a major freeway), and recommendations for immediate and long-term flood alleviation works are provided. (CSIRO)
W77-01069

COMPRESSION OF TIME-SERIES DATA,
Ministry of Works, Wellington (New Zealand). Water and Soil Div.
For primary bibliographic entry see Field 7C.
W77-01132

RAINFALL AND FLOODS IN INDIA DURING 1973 SOUTHWEST MONSOON PERIOD,
Meteorological Office, New Delhi (India).
For primary bibliographic entry see Field 2B.
W77-01329

COMPARISON OF TWO MATHEMATICAL MODELS OF SURFACE RUNOFF,
New Mexico Inst. of Mining and Technology, Socorro.
V. P. Singh.
Hydrological Sciences Bulletin, Vol. 21, No. 2, p 285-299, June 1976. 12 fig, 6 tab, 16 ref.

Descriptors: *Mathematical models, *Model studies, Runoff, Surface runoff, Discharge, Agricultural watersheds, Terracing, Kinetics, Peak discharge, Hydrographs.
Identifiers: *Surface runoff models, Agricultural basins, Terraced basins, Linear model, Natural agricultural basins, Kinematic wave model.

A comparative assessment of two mathematical models of surface runoff was made by applying them to 21 terraced and unterraced natural agricultural basins located in two geographically different regions. The models included a nonlinear kinematic wave model based on the converging section geometry and Nash's linear model (NASH). The criteria for comparison included prediction of hydrograph peak, hydrograph peak time and the entire hydrograph, and some elementary statistical tests. It was shown that converging section geometry had a tendency to overpredict both peak discharge and its time of occurrence, while NASH had a tendency to underpredict them. It was also shown that because of its nonlinear character, converging section geometry was more sensitive to errors in the input than NASH was. Furthermore, one model could not be uniformly better than the other. It was concluded that the choice of a particular model depends on the criterion of comparison. (Roberts-ISWS)
W77-01334

APPLICATION OF A PARAMETRIC MODEL TO SIMULATE FLOWS FROM AN URBAN WATERSHED,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2A.
W77-01339

GEOMETRY OF RIVER MEANDERS,
University of East Anglia, Norwich (England). School of Environmental Sciences.
R. D. Hey.
Nature, Vol. 262, No. 5568, p 482-484, August 1976. 3 fig, 1 tab, 7 ref.

Descriptors: *Meanders, *Geomorphology, *Wavelengths, *Turbulence, *Eddies, Hydraulics, Numerical analysis, Hydrologic data, Channel flow, Europe.
Identifiers: *Wye and Tweed Rivers(UK), Yalin's equations, Meander angle.

There are many factors affecting the geometry of river meanders. On the basis of theoretical analysis, Yalin related the wavelength of the meanders to the width, w, of the channel as 2 pi times w for fully developed turbulent flow. Leopold and Wolman's equations for the wavelength and radius of curvature for the meanders were shown not to fit the observed data for the Wye and Tweed rivers in the United Kingdom. Introduction of the meander arc angle in the relation between wavelength and chanel width allows satisfactory fit of the data. The constat of proportionality in Yalin's equation needs to be twice the value because the average size of the macroturbulent eddy is half the channel width. Sinuosity is probably the best measure to define the plan geometry of river channels for design purposes. Arc length is shown to be a unique function of channel width, which in turn is defined by the bank competence equations. (Singh-ISWS)
W77-01340

TETON DAM FLOOD OF JUNE 1976, MORELAND QUADRANGLE, IDAHO,
Geological Survey, Boise, Idaho.
For primary bibliographic entry see Field 7C.
W77-01395

TETON DAM FLOOD OF JUNE 1976, FIRTH QUADRANGLE, IDAHO,
Geological Survey, Boise, Idaho.
For primary bibliographic entry see Field 7C.
W77-01396

TETON DAM FLOOD OF JUNE 1976, ROSE QUADRANGLE, IDAHO,
Geological Survey, Boise, Idaho.
For primary bibliographic entry see Field 7C.
W77-01397

TETON DAM FLOOD OF JUNE 1976, MENAN BUTTES QUADRANGLE, IDAHO,
Geological Survey, Boise, Idaho.
For primary bibliographic entry see Field 7C.
W77-01398

TETON DAM FLOOD OF JUNE 1976, NEWDALE QUADRANGLE, IDAHO,
Geological Survey, Boise, Idaho.
For primary bibliographic entry see Field 7C.
W77-01399

TETON DAM FLOOD OF JUNE 1976, PARKER QUADRANGLE, IDAHO,
Geological Survey, Boise, Idaho.
For primary bibliographic entry see Field 7C.
W77-01400

TETON DAM FLOOD OF JUNE 1976, BLACKFOOT QUADRANGLE, IDAHO,
Geological Survey, Boise, Idaho.
For primary bibliographic entry see Field 7C.
W77-01401

TETON DAM FLOOD OF JUNE 1976, PINGREE QUADRANGLE, IDAHO,
Geological Survey, Boise, Idaho.
For primary bibliographic entry see Field 7C.
W77-01402

TETON DAM FLOOD OF JUNE 1976, MOODY QUADRANGLE, IDAHO,
Geological Survey, Boise, Idaho.
For primary bibliographic entry see Field 7C.
W77-01403

TETON DAM FLOOD OF JUNE 1976, REXBURG QUADRANGLE, IDAHO,
Geological Survey, Boise, Idaho.
For primary bibliographic entry see Field 7C.
W77-01404

TETON DAM FLOOD OF JUNE 1976, RIGBY QUADRANGLE, IDAHO,
Geological Survey, Boise, Idaho.
For primary bibliographic entry see Field 7C.
W77-01405

TETON DAM FLOOD OF JUNE 1976, LEWISVILLE QUADRANGLE, IDAHO,
Geological Survey, Boise, Idaho.
For primary bibliographic entry see Field 7C.
W77-01406

TETON DAM FLOOD OF JUNE 1976, WOODVILLE QUADRANGLE, IDAHO,
Geological Survey, Boise, Idaho.
For primary bibliographic entry see Field 7C.
W77-01407

TETON DAM FLOOD OF JUNE 1976, ST. ANTHONY QUADRANGLE, IDAHO,
Geological Survey, Boise, Idaho.
For primary bibliographic entry see Field 7C.
W77-01408

TETON DAM FLOOD OF JUNE 1976, DEER PARKS QUADRANGLE, IDAHO,
Geological Survey, Boise, Idaho.
For primary bibliographic entry see Field 7C.
W77-01409

TETON DAM FLOOD OF JUNE 1976, IDAHO FALLS SOUTH QUADRANGLE, IDAHO,
Geological Survey, Boise, Idaho.
For primary bibliographic entry see Field 7C.
W77-01410

TETON DAM FLOOD OF JUNE 1976, IDAHO FALLS NORTH QUADRANGLE, IDAHO,
Geological Survey, Boise, Idaho.
For primary bibliographic entry see Field 7C.
W77-01411

SURFACE WATER SUPPLY OF THE UNITED STATES, 1966-70: PART 3. OHIO RIVER BASIN--VOLUME 1. OHIO RIVER BASIN ABOVE KANAWHA RIVER.
Geological Survey, Reston, Va.
For primary bibliographic entry see Field 7C.
W77-01412

SURFACE WATER SUPPLY OF THE UNITED STATES, 1966-70: PART II. PACIFIC SLOPE BASINS IN CALIFORNIA--VOLUME 4. NORTHERN CENTRAL VALLEY BASINS.
Geological Survey, Reston, Va.
For primary bibliographic entry see Field 7C.
W77-01413

STATISTICAL ANALYSIS OF WATER-LEVEL SPRINGFLOW, AND STREAMFLOW DATA FOR THE EDWARDS AQUIFER IN SOUTH-CENTRAL TEXAS,
Geological Survey, Austin, Tex.
For primary bibliographic entry see Field 4B.
W77-01417

HYDROLOGIC DATA FOR URBAN STUDIES IN THE HOUSTON, TEXAS METROPOLITAN AREA, 1974,
Geological Survey, Austin, Tex.
For primary bibliographic entry see Field 7C.
W77-01419

MAXIMUM PEAK FLOW FOR SELECTED RETURN PERIODS FOR WATERSHEDS WEST OF THE CONTINENTAL DIVIDE IN IDAHO AND MONTANA,
Forest Service (USDA), Ogden Utah. Intermountain Forest and Range Experiment Station.
For primary bibliographic entry see Field 4D.
W77-01435

FLOOD PROBLEMS IN UTTAR PRADESH,
Irrigation Commission, Lucknow (India).
A. C. Chaturvedi.
The Civil Engineer in South Africa, Vol 17 (10), p 267-269, 321 (1975), Vol 17 (12), p 321, (1975). 1 fig, 1 tab.

Descriptors: *Flood control, Flood damage, *Flood forecasting, Financing, Future planning, Maintenance.
Identifiers: *India, *Uttar Pradesh.

Flood problems in Uttar Pradesh, the largest state in India are discussed. Attention is given to the rainfall pattern, flood damage, past measures, execution of flood works, flood forecasting, future measures contemplated, financing of flood works and proposed maintenance of flood works. (South Africa)
W77-01450

2F. Groundwater

HYDROGEOLOGY OF THE QUATERNARY AND TERTIARY FORMATIONS ALONG THE SOUTH COAST OF THE ALGARVE PORTUGAL,
Vrije Universiteit, Amsterdam (Netherlands). Inst. of Earth Sciences.
H. Speelman, and H. Ryckborst.
Hydrological Sciences Bulletin, Vol 21, No 2, p 345-356, June 1976. 8 fig, 2 tab, 7 ref.

Descriptors: *Hydrogeology, *Areal hydrogeology, *Aquifers, Groundwater, Coasts, Saline water intrusion, Geology, Wells, Transmissivity, Hydraulic conductivity, Tidal effects, Water levels, Model studies, On-site investigations, Water quality.
Identifiers: *Portugal.

Excessive groundwater withdrawal along the South coast of Portugal threatens the continued existence of the freshwater supply. The heavy pumping of groundwater is induced partly by the spectacular growth of the tourist industry since 1968 and partly by the new irrigation techniques for the citrus industry. In order to assess the present freshwater situation, a study was carried out in which the Quarteira area was selected as a representative zone for the southern part of the Province of Algarve. It was found that the Quaternary and Tertiary deposits on the south coast of Portugal are distinguished by their excellent aquifer characteristics. The transmissivity of the Pleistocene-Pliocene formations reaches a maximum of 1550 sq m/d. In comparison the Miocene deposits are fairly good aquifers with a transmissivity of about 270 sq m/d. Among the Holocene deposits, the barrier dunes show reasonably good water-bearing qualities. The good hydraulic conductivities (19-22 m/d) result in a flat shape of the groundwater table and freshwater flows towards the ocean. Excessive groundwater withdrawal has caused seawater intrusion. The locations of the seawater intrusions correspond with those centers where a spectacular growth of the tourist industry has taken place since 1968, and also with those

areas where new developments in the irrigation techniques for the citrus industry have been applied. On the ocean front where seawater intrusion occurs, the thickness of the freshwater lens has been reduced to 27-32 m. (Sims-ISWS)
W77-01136

HYDRODYNAMICS OF PERCHED MOUNDS,
California State Univ., Fullerton. Dept. of Civil Engineering.
For primary bibliographic entry see Field 4B.
W77-01141

UNSTEADY GROUNDWATER FLOW BENEATH STRIP OCEANIC ISLANDS,
Wisconsin Univ., Madison. Dept. of Geology and Geophysics.
M. P. Anderson.
Water Resources Research, Vol. 12, No. 4, p 640-644, August 1976. 7 fig, 24 ref.

Descriptors: *New York, *Groundwater movement, *Model studies, Groundwater, Dupuit-Forchheimer theory, Wells, Hydrographs, Freshwater, Groundwater recharge, Hydrology.
Identifiers: *Ocean Island, *Long Island(NY), Continuously moving interface model, Delayed interface response model, Salt water.

Two one-dimensional models based on the Dupuit-Forchheimer assumptions to simulate flow beneath strip oceanic islands were presented. A model which was here designated the continuously moving interface (CMI) model was solved by finite differences. The solution agreed well with an analytical solution for a particular case given by Collins (1976). Because of its long response time, the CMI model was not able to simulate short-term fluctuations in water level in a well located on the South Fork of Long Island, New York. A second model, designated the delayed interface response (DIR) model, could reproduce the average hydrograph of the well and the decline in water level during most of an extended drought. However, because the model required discontinuous movement of the interface between freshwater and salt water, some error was introduced into the solutions. The DIR model was used to predict the response of water levels to modifications in recharge patterns on the South Fork of Long Island. (Lee-ISWS)
W77-01143

NITRATE AND CHLORIDE POLLUTION OF AQUIFERS: A REGIONAL STUDY WITH THE AID OF A SINGLE-CELL MODEL,
Tahal-Water Planning for Israel, Ltd. Tel-Aviv.
For primary bibliographic entry see Field 5B.
W77-01145

REDUCTION OF POROSITY BY PRESSURE SOLUTION: EXPERIMENTAL VERIFICATION,
Stanford Univ., Calif. Dept. of Geophysics.
E. S. Sprunt, and A. Nur.
Geology, Vol. 4, No. 8, p 463-466, August 1976. 5 fig, 10 ref. NASA NSG-7117.

Descriptors: *Porosity, *Pressure, *Sandstones, Pores, Stress, Laboratory tests, Hydrostatic pressure, Particle size, Rocks, Groundwater, Geology.
Identifiers: *Pressure solution.

Under nonhydrostatic stress, the porosity of water-saturated St. Peter sandstone was reduced by more than 50% through pressure solution. The rate of porosity reduction was dependent on the pore fluid pressure. Hydrostatic pressure alone resulted in no porosity reduction, which indicates that shear stress is necessary for the reduction of porosity by pressure solution. (Sims-ISWS)
W77-01332

A SIMPLE COMPUTER PROGRAM FOR THE DETERMINATION OF AQUIFER CHARACTERISTICS FROM PUMP TEST DATA,
Southwest Florida Water Management District, Brooksville.
For primary bibliographic entry see Field 7C.
W77-01337

COMPARATIVE EFFICIENCY OF GEOPHYSICAL PROSPECTING TECHNIQUES IN WATER-SATURATED SANDS,
National Physical Research Lab., Pretoria (South Africa).
P. F. Worthington.
Water SA., Vol 1(1), p 9-14, (1975). 2 fig, 2 tab, 17 ref.

Descriptors: *Saturated soils, *Resistivity, *Seismic properties, Aquifers, *Exploration, Water resources, Water quality, Geophysics, *Sands.

A critical appraisal is made of the relative usefulness of the electrical resistivity and seismic refraction methods in detailed exploration of arenaceous aquifers. It is demonstrated that both techniques are useful in the mapping of aquifer boundaries although the field procedure for the refraction method is more complex. Seismic refraction is more useful in locating the water-table, but the mapping of water quality necessarily uses electrical resistivity. The accuracy of measurement of formation resistivity factor and compressional wave velocity is considered with regard to the prediction of effective porosity and intergranular permeability. It is concluded that the formation resistivity factor is a significantly better indicator of both these hydrological parameters. Thus the resistivity method should be the prime tool in the geophysical exploration of arenaceous aquifers with seismic refraction having a supporting but nevertheless important role. (South Africa)
W77-01361

GEOPHYSICAL EXPLORATION FOR POTABLE GROUNDWATER SUPPLIES IN THE KALAHARI GEMSBOK NATIONAL PARK,
Ruker (Richard) and Associates, Bryanston (South Africa).
For primary bibliographic entry see Field 4B.
W77-01366

GROUND-WATER DATA FOR THE SANTA MARIA VALLEY, CALIFORNIA,
Geological Survey, Menlo Park, Calif.
For primary bibliographic entry see Field 4B.
W77-01415

STATISTICAL ANALYSIS OF WATER-LEVEL SPRINGFLOW, AND STREAMFLOW DATA FOR THE EDWARDS AQUIFER IN SOUTH-CENTRAL TEXAS,
Geological Survey, Austin, Tex.
For primary bibliographic entry see Field 4B.
W77-01417

ESTIMATED GROUNDWATER YIELD FOLLOWING STRIP CUTTING IN PINE PLANTATIONS,
Forest Service (USDA), Cadillac, Mich. North Central Forest Experiment Station.
For primary bibliographic entry see Field 4C.
W77-01426

HYDROGEOLOGICAL AND GEOPHYSICAL INVESTIGATIONS OF A GEOTHERMAL ANOMALY IN HUNGARY; II. GEOTHERMAL FLOW SYSTEM IN THE TISZAKECSKE REGION,
Research Inst. for Water Resources Development, Budapest (Hungary).
For primary bibliographic entry see Field 4B.
W77-01436

PINPOINTING BOREHOLES ELECTRICALLY.
Construction in Southern Africa, Vol 20 (7), p 77-79, (1975).

Descriptors: Water wells, *Boreholes, Groundwater resources, *Resistivity, Hydrogeology.
Identifiers: South Africa, *South West Africa.

According to the Geophysics Division of the CSIR's National Physical Research Laboratory the experimental use of electrical soundings for pinpointing water is showing highly encouraging results, even in the arid northern areas of South West Africa. The technique is based on the fact that different geological formations often have differing electrical resistivities, which can now be determined by passing a current through the ground between two electrodes and measuring the resulting potential difference between a further pair. (South Africa)
W77-01448

EVALUATION OF GEO-HYDROLOGIC CONSTANTS FOR THE FAR WEST RAND DOLOMITIC FORMATIONS,
University of the Witwatersrand, Johannesburg (South Africa). Dept. of Civil Engineering.
For primary bibliographic entry see Field 4B.
W77-01449

2G. Water In Soils

PERCOLATION OF SURFACE-APPLIED WATER IN THE FIELD,
Kentucky Agricultural Experimental Station, Lexington.
V. L. Quisenberry, and R. E. Phillips.
Soil Science Society of America Journal, Vol 40, No 4, p 484-489, July-August 1976. 10 fig, 10 ref.

Descriptors: *Percolation, *Soil water movement, *Soils, *Irrigation, Chlorides, Tracers, Unsaturated flow, Groundwater movement, Infiltration, Percolating water, Porosity, Soil moisture, Soil water, Topsoil, Loam, Clay loam, Rainfall, Agriculture.

Percolation of surface-applied water tagged with chloride was studied in Maury silt loam and Huntington silty clay loam under field conditions. Soil samples were taken in small increments to the 90-cm depth several times following application of water. Analyses of chloride content with depth indicated the position of the applied water relative to the initial soil water in the profile. Three percolation studies were conducted on Maury silt loam soil. In the first study, an application of 4.2-cm of water increased the water content to the 60-cm depth within 1 hour following irrigation even though the volumetric water profile averaged 5% below the upper limit of the water holding capacity through this depth. A second study conducted at a slightly higher initial water content showed that 20% of a 4.2-cm application had penetrated below the 90-cm depth immediately after application and 40% penetrated below this depth within 1 hour. Similar results were measured in Huntington silty clay loam. Simulated rainfall increased the water content significantly to approximately the 15-cm depth in each of three studies. A large percentage of the water passing this depth apparently percolated past the 90-cm depth with very little adsorption of water and chloride between these depths. Location of chloride in the profile and movement of chloride past the 90-cm depth indicated that a large percentage of the applied water percolated past the water initially present with little displacement of the initial water. (Sims-ISWS)
W77-01137

COUPLING PHENOMENA IN SATURATED HOMO-IONIC MONTMORILLONITE: I. EXPERIMENTAL,
Guelph Univ. (Ontario). Dept. of Land Resource Science.

D. E. Elrick, D. E. Smiles, N. Baumgartner, and P. H. Groenevelt.
Soil Science Society of America Journal, Vol 40, No 4, p 490-491, July-August 1976. 3 fig, 2 ref.

Descriptors: *Clays, *Montmorillonite, *Soil physical properties, *Soil water movement, Pressure, Salts, Sodium chloride, Electrical properties, Electrochemistry, Membranes, Laboratory tests, Soil water, Groundwater, Soil science.

A series of experiments was performed to observe the effects of salt concentration differences across a thin layer of homo-ionic montmorillonite. The water pressure difference, concentration difference, and voltage difference measured with electrodes reversible to the anion were observed as functions of time. A qualitative explanation of the observations was proposed. (Sims-ISWS)
W77-01138

WATER TRANSPORT IN THE SOIL-ROOT SYSTEM: TRANSIENT ANALYSIS,
Auburn Univ., Ala. Dept. of Civil Engineering.
F. J. Molz.
Water Resources Research, Vol. 12, No. 4, p 805-808, August 1976. 2 fig, 27 ref.

Descriptors: *Soil water movement, *Root zone, *Root systems, *Equations, Soils, Unsteady flow, Potential flow, Numerical analysis, Hydraulic gradient, Available water, Mathematical models, Theoretical analysis, Boundaries(Surfaces), Xylem, Plant tissues, Hydraulic conductivity, Laboratory tests.
Identifiers: *Root cortex, Specific moisture capacity, Endodermis, Darcy-Richards equation, Pachappa sandy loam.

Equations were developed which describe the transient flow of water in a cylindrical soil-root system. The main objective was to calculate water potential distributions in the root cortex as well as in the surrounding soil. Numerical results indicated that there will be small water potential gradients in the soil relative to those in the root in the upper 90% of the water availability range. Contrary to past experiments, theory predicted that appreciable amounts of water should flow from roots to soil when roots well supplied with water are in contact with dry soil. An important implication of the study was that models designed to predict the pattern in which roots extract water from soil will have to consider the rate-limiting aspect of the root tissue. (Visocky-ISWS)
W77-01147

RATING OF IRRIGATED SOILS OF THE SAL'YAN REGION, (IN RUSSIAN),
M. E. Salaev, and R. A. Alieva.
Izv Akad Nauk Az SSR Ser Biol Nauk 1, p 54-59. 1975.

Descriptors: *Soils, *Irrigated lands, Irrigation, Regions, *Absorption, *Soil properties, Phosphorus, Nitrogen, Oxygen, Humus, *Soil classification.
Identifiers: *Aal'yan region(USSR).

A method of rating soils of irrigated regions (USSR), a regional rating scale and appropriate correction factors for individual soil characteristics were developed. The principal, most stable intrinsic soil properties were used as the criterion for rating the soil, the average values of humus, N, P and absorption capacity in the 0-20, 0-50 and 0-100-cm layers.--Copyright 1976, Biological Abstracts, Inc.
W77-01208

UNSTEADY FLOW OF WATER THROUGH SOILS DRAINED BY PARALLEL DITCHES, (IN FRENCH),
Thessaloniki Univ., Salonika (Greece). Faculty of Agronomy.
C. Tzimopoulos, and G. Terzidis.
J Hydrol (AMST) 27(1/2), p 73-93, 1975.

Descriptors: *Soils, *Unsteady flow, *Soil water movement, *Drainage, Equations model studies, Ditches, Europe.
Identifiers: *Boussinesq equation, *Greece.

The water movement through soils drained by parallel ditches is in general unsteady and can be described by the nonlinear Boussinesq equation. An analytical solution of this drainage equation subjected to general initial and boundary conditions has not yet been found because of its nonlinearity. Numberical methods should be used to obtain approximate solutions of the mixed boundary value problems of this equation. Numerical solutions are presented based on implicit computational schemes of the Crank-Nicolson, Laasonen and Douglas types. Experimental data, obtained by a Hele-Shaw model in the Hydraulics Laboratory of the School of Agriculture of the University of Thessaloniki (Greece), are in very good agreement with the values computed numerically by these implicit schemes.--Copyright 1976, Biological Abstracts, Inc.
W77-01219

WATER AND SALT DISTRIBUTION IN A SOIL UNDER TRICKLE IRRIGATION,
Arizona Univ., Tucson. Dept. of Soils, Water, and Engineering.
For primary bibliographic entry see Field 3C.
W77-01271

LEAF WATER POTENTIAL AND STOMATAL ACTIVITY IN SORGHUM AS INFLUENCED BY SOIL MOISTURE STRESS,
Nebraska Univ., Lincoln. Dept. of Horticulture and Forestry.
For primary bibliographic entry see Field 2I.
W77-01276

A NOTE ON THE USE OF BENTONITE CLAY AS A SUB-SOIL MOISTURE BARRIER FOR VEGETABLE PRODUCTION ON DRYLANDS OF RAJASTHAN,
Central Arid Zone Research Inst., Jodhpur (India).
For primary bibliographic entry see Field 3F.
W77-01277

SOIL MOISTURE USE BY VELVET MESQUITE (PROSOPIS JULIFLORA),
Arizona Univ., Tucson. School of Renewable Natural Resources.
R. C. Martin.
Master of Science Thesis, 1976. 9 fig, 1 tab, 12 ref, append.

Descriptors: *Soil moisture, *Soil water, *Soil-water-plant relationships, *Mesquite, *Water utilization, Soil water movement, Soil moisture meters, Moisture content, *Arizona, Desert plants, Range grasses, Watershed management, Vegetation, Water loss, Transpiration, Infiltration, Surface runoff.
Identifiers: Neutron thermalization, Prosopisis juliflora, Velvet mesquite.

A study was conducted to determine the amount of soil moisture used by the mature velvet mesquite trees on an upland site in southern Arizona. In addition, the moisture used by the trees at various distances from their trunks was quantified. Using the neutron thermalization method, soil moisture measurements were made adjacent to four live and four dead trees. Soil moisture levels at selected distances from the live and dead trees were compared and the differences graphically evaluated to determine seasonal soil moisture use. The results are presented. Despite problems encountered, the method offers a means of determining the quantity of moisture use by plants without significantly altering their immediate environment. (Jamail-Arizona)
W77-01283

THE EFFECT OF ENVIRONMENTAL FACTORS ON THE GROWTH OF A NATURAL PASTURE,
Hebrew Univ., Jerusalem (Israel). Dept. of Botany.
For primary bibliographic entry see Field 2I.
W77-01285

INFLUENCE OF HYSTERESIS ON MOISTURE FLOW IN AN UNDISTURBED SOIL MONOLITH,
Goettingen Univ. (West Germany). Inst. of Soil Science and Forest Nutrition.
F. Beese, and R. R. van der Ploeg.
Soil Science Society of America Journal, Vol. 40, No. 4, p 480-484, July-August 1976. 8 fig, 17 ref.

Descriptors: *Soil moisture, *Hysteresis, *Drying, *Wetting, Soils, Podzols, Gray-brown podzolic soils, Physical properties, Lysimeters, Infiltration, Unsaturated flow, Soil properties, Soil water, Diffusion, Soil water movement, Mathematical models, Model studies, Laboratory tests, Sorption, Soil science.
Identifiers: *Soil suction.

The moisture dynamics of an undisturbed soil monolith were studied during a lysimeter experiment. Daily measurements were made of the soil suction at 10 depths. Also measured daily were the precipitation, the seepage, and the evaporation from the monolith during a 3-year period. For selected periods, a drying (desorption) curve and a wetting (sorption) curve of the soil moisture characteristic were determined from field data. Also, the capillary conductivity was determined with use of daily monolith observations. By using these hydraulic functions, the unsaturated soil moisture flow equation was solved numerically for one-dimensional vertical flow. In order to determine the effect of hysteresis on the suction distribution in the monolith, calculations were performed either with the desorption curve or with the sorption curve without scanning between the curves. Neither of the two curves led to complete agreement between observed and calculated soil suction values; the desorption curve usually gave too high values, and the sorption curve gave too low values. (Sims-ISWS)
W77-01323

RADIATION HAZARD FROM AMERICIUM-BERYLLIUM NEUTRON MOISTURE PROBES,
North Dakota State Univ., Fargo. Dept. of Soils.
G. W. Gee, J. F. Stiver, and H. R. Borchert.
Soil Science Society of America Journal, Vol. 40, No. 4, p 492-494, July-August 1976. 3 fig, 1 tab, 4 ref.

Descriptors: *Soil moisture meters, *Nuclear moisture meters, *Hazards, *Radiation, Soil moisture, Radioactivity, Safety, Instrumentation, Equipment, Monitoring, Measurement, Soil science.
Identifiers: *Radiation hazards, Fast neutrons, Radiation doses.

Neutron fluxes from shielded neutron moisture probes need to be measured to evaluate total radiation exposure from these instruments. Theoretical considerations suggest that for 100 mCi Am-Be neutron moisture probes the fast neutron flux can be relatively high and contribute significantly to the radiation exposure of probe operators. Measured radiation dose levels at the surface of 100 mCi Am-Be neutron probes manufactured by Troxler Laboratories were found to be as high as 37 m Rem/hour which exceeds reported levels by as much as 38 times. This was believed to be due to nonreporting of fast neutron fluxes. It was mentioned that conventional field use of these probes may present a radiation hazard to operators if the probe is hand carried for periods which exceed three hours per week. It was recommended that the probe be transported to and from sites inside a wooden storage crate and be kept at least 1 m from

personnel. Also, to improve the radiation safety factor for on site use, it was recommended that a hand cart be used to transport the probe. (Sims-ISWS)
W77-01324

MEASURING HYDROLOGIC PROPERTIES OF SOIL WITH A DOUBLE-RING INFILTROMETER AND MULTIPLE-DEPTH TENSIOMETERS,
Hawaii Univ., Honolulu. Dept. of Agronomy and Soil Science.
L. R. Ahuja, S. A. El-Swaify, and A. Rahman.
Soil Science Society of America Journal, Vol. 40, No. 4, p 494-499, July-August 1976. 10 fig, 1 tab, 5 ref.

Descriptors: *Hydrologic properties, *Soil water movement, *Soil physical properties, *Hawaii, Soil properties, *Infiltration, *Infiltrometers, *Tensiometers, On-site investigations, Forests, Forest watersheds, Soils, Loam, Clay loam, Percolation, Groundwater movement, Water spreading, Soil science, Instrumentation.
Identifiers: Soil-water characteristics.

A ring infiltrometer with varying width of buffer zone in combination with multiple-depth tensiometers was tested for determining the hydrologic properties of a Typic Dystrandept (Tantalus silty clay loam) soil profile on a forested watershed in Hawaii. With location of one multiple-depth tensiometer at the vertical axis of the axisymmetric flow system and one or more at a given radius outside the inner ring, the vertical and the radial hydraulic gradients could be simultaneously measured. It was thus possible to estimate the lateral flow components and to determine vertical infiltration rates and hydraulic conductivites (at field saturation) of the different soil horizons. Lateral flow decreased with time during infiltration. Under the moist-to-wet conditions of the soil under study, lateral flow was not appreciable. From an inner ring of 30-cm diameter, the lateral flow was practically eliminated when a buffer ring of 90-cm diameter was employed. The effect of lateral flow on the final infiltration rate was negligible even when a buffer ring of 60-cm diameter was used. (Sims-ISWS)
W77-01325

VISCOSITY OF INTERLAYER WATER IN MONTMORILLONITE,
Purdue Univ., Lafayette, Ind. Dept. of Agronomy.
P. F. Low.
Soil Science Society of America Journal, Vol. 40, No. 4, p 500-505, July-August 1976. 4 fig, 1 tab, 30 ref.

Descriptors: *Viscosity, *Permeability, *Clays, *Montmorillonite, *Viscous flow, Flow resistance, Diffusion, Hydraulic conductivity, Porous media, Soils, Soil properties, Physical properties, Analytical techniques, Groundwater movement, Soil water movement, Soil science.

The viscosities of water in Na-montmorillonite system at various water contents were calculated by different equations using data from experiments conducted by different investigators on: (1) viscous flow of water at different temperatures, (2) self-diffusion of water, and (3) neutron scattering by water. The results were remarkably consistent and showed that the viscosity of the interlayer water is greater than that of bulk water and increases exponentially with decreasing water content. Evidence was also presented to show that the viscosity of this water depends on the b-dimension of the associated montmorillonite. By combining the data on viscosity with data on hydraulic conductivity, it was possible to determine the permeability of the montmorillonite at different water contents. (Sims-ISWS)
W77-01326

HEAT AND WATER MOVEMENT UNDER SURFACE ROCKS IN A FIELD SOIL: I. THERMAL EFFECTS,
California Univ., Riverside. Dept. of Soil Science and Agricultural Engineering.
W. A. Jury, and B. Bellantuoni.
Soil Science Society of America Journal, Vol. 40, No. 4, p 505-509, July-August 1976. 6 fig, 2 tab, 13 ref.

Descriptors: *Soils, *Rocks, *Heat flow, *Soil moisture, Soil water movement, On-site investigations, Model studies, Mathematical models, Thermal conductivity, Water vapor, Mulching, Droughts, Arid lands, Groundwater movement, Soil science.
Identifiers: Water vapor movement, Thermal effects.

Results of a field experiment designed to evaluate the effect of surface rocks on soil heat flow were presented. Temperature observations were made by thermocouples at 12 locations under and adjacent to rocks placed over bare soil. Continuous readings were taken for 24- and 48-hour intervals using seven different kinds of rock cover, ranging from large granite slabs to gravel piles, during the time between December 1974 and August 1975. Experimental results consistently showed a non-negligible 24-hour net horizontal heat flow toward the rock at both the 2.5 and 5.0 cm depth. Net vertical heat flow was always downward in the soil under the bare surface but was observed to be either upward or downward in the soil under the rock cover depending on prior conditions. Because water vapor movement in moist soil is generally in the same direction as heat flow, it was suggested that surface rock cover may be a mechanism for water collection in arid climates. A simulation model was constructed to describe two-dimensional heat flow in a uniform soil with a rectangular rock on the surface. Using the measured surface temperature as boundary values and a soil thermal conductivity corresponding to the mean daily soil surface temperature, the simulation model adequately reproduced the observed temperatures under and adjacent to the rock. (See also W77-01328) (Sims-ISWS)
W77-01327

HEAT AND WATER MOVEMENT UNDER SURFACE ROCKS IN A FIELD SOIL: II. MOISTURE EFFECTS,
California Univ., Riverside. Dept. of Soil Science and Agricultural Engineering.
W. A. Jury, and B. Bellantouni.
Soil Science Society of America Journal, Vol. 40, No. 4, p 509-513, July-August 1976. 5 fig, 3 tab, 7 ref.

Descriptors: *Soils, *Rocks, *Heat flow, *Soil moisture, Soil water movement, On-site investigations, Laboratory tests, Model studies, Mathematical models, Computer models, Thermal conductivity, Water vapor, Mulching, Droughts, Arid lands, Groundwater movement, Soil science.
Identifiers: Water vapor movement, Moisture effects.

Results were presented from a field experiment conducted to determine the effect of surface rocks on soil water content change under bare soil. First, stones were placed at intervals over an initially dry field (gravimetric water content = 0.021 g/g) and left for 6 weeks. Subsequent sampling showed a small, but detectable, excess of water stored under the rock compared to adjacent bare soil. Following an irrigation, buried thermal conductivity probes were used to monitor water content changes under and adjacent to surface rocks. After 24 days, the soil under the rock contained significantly more water than did the soil region adjacent to the rock, a finding confirmed by gravimetric sampling. Following this, the stones and probes were relocated for a further 24 days of observation, with similar results obtained. In a separate laboratory experiment using a large, sealed soil column with a rock covering part of the surface, it was demonstrated that a significant amount of water moved to the cylinder of soil under the rock from the soil region under the bare surface due to horizontal temperature gradients induced by the rock covering part of the surface. A two-dimensional computer program calculating water vapor movement under thermal gradients was used with measured field temperature boundary conditions to estimate the amount of water vapor movement expected to occur due to a rock cover on the soil surface. Results qualitatively confirmed the observations of the sealed laboratory column experiment. (See also W77-01327) (Sims-ISWS)
W77-01328

ENVIRONMENT POLLUTION BY ORGANOPHOSPHORUS COMPOUNDS, (IN RUSSIAN),
Vsesoyuznyi Nauchno-Issledovatelskii Institut Gigieni I Toksikologii Pestitsidov, Kiev (USSR).
For primary bibliographic entry see Field 5B.
W77-01352

SOME SOIL HYDRAULIC CONSIDERATIONS IN LIQUID WASTE DISPOSAL,
Department of Agricultural Technical Services, Pretoria (South Africa).
For primary bibliographic entry see Field 5E.
W77-01354

A RECORDING SOIL MOISTURE TENSIOMETER,
Forest Service (USDA), Portland, Oreg. Pacific Northwest Forest and Range Experiment Station.
W. J. Walkotten.
Research Note PNW-180, June 1972, 12 p, 6 fig, 4 ref.

Descriptors: *Tensiometers, *Soil moisture, Soil management, *Instrumentation, Measurement.

A recording water-saturated porous cup tensiometer that operates in the negative pressure range of a mercury manometer-type tensiometer provides a continuous record of soil moisture tension for periods up to 31 days. This instrument detect small moisture changes and diurnal fluctuations; it has also shown rapid response to increasing soil moisture during rainfall. Parts and material for construction cost less than $150. (Forest Service)
W77-01429

MULCH AND MICROCLIMATE: THE SIGNIFICANCE OF MULCH AND THE CHANGE IN TEMPERATURE BEHAVIOR RESULTING FROM IT, (IN DUTCH),
Agricultural Univ., Wageningen (Netherlands). Lab. of Physics and Meteorology.
E. A. R. Mellaart.
Meded Landbouwhogesch Wageningen. 75(5), p 1-30, 1975.

Descriptors: Equations, *Mulching, *Soil microbiology, *Soil treatment, *Soil investigations, *Soil structure, Evaporation control, Soil moisture, Soil properties, Cultivation, Plant diseases, Toxins.
Identifiers: Plant pests.

An equation is developed comparing a homogeneous and a mulched soil receiving the same amount of radiation. The possible influence on evaporation is also discussed. Most mulches affect the biological activities of the soil, usually due to changes in temperature, moisture content and often pH, soil structure, etc. In recent reports comparing tilled with untilled mulched fields, the soil structure and biological activity of the untilled fields was as good, if not better than those of mulched fields that were tilled. On the other hand, plant diseases and pests may be encouraged by mulching. Damage may also be done by the extraction of toxic substances from the mulch.--Copyright 1975, Biological Abstracts, Inc.

W77-01447

SOIL-WATER-PLANT RELATIONSHIPS - IMPORTANT DESIGN CRITERIA FOR IRRIGATION-PLANNING, (GROND-PLANT-WATER-VERHOUDINGS AS BELANGRIKE ONTWERP-GEGEWENS VIR BESPROEIING-SBEPLANNING),
Stellenbosch Univ. (South Africa). Dept. of Agriculture.
For primary bibliographic entry see Field 3C.
W77-01454

AMELIORATION OF SUBSURFACE ACIDITY BY LEACHING OF SURFACE APPLIED AMENDMENTS. A LABORATORY STUDY,
Fruit and Fruit Technology, Research Inst., Stellenbosch (South Africa).
W. A. G. Kotze, and J. Deist.
Agrochemophysica 7, p 39-45, (1975). 4 fig, 4 tab, 21 ref.

Descriptors: *Leaching, Ion exchange, *Acidic soils, *Clay minerals, Calcium, Calcium hydroxide, *Calcium compounds, Gypsum, Nitrates, *Soil treatment.
Identifiers: South Africa, Calcium nitrate.

Ca:Al exchange equilibria in acid soils and clay minerals indicated that Al is strongly preferred to Ca on the exchange complex, but that Al concentration in the equilibrium solution is low when Al saturation of the exchange complex is less than 60 to 80%. Leaching of soil columns after application of Ca(OH)2, Ca-nitrate and gypsum indicated that the effect of Ca(OH)2 was limited to the site of application, whereas Ca-nitrate and gypsum increased exchangeable Ca and decreased Al throughout the column. The decrease in exchangeable Al was ascribed to an anion induced polymerization of Al as well as exchange and leaching of Al by Ca. (South Africa)
W77-01483

SPECIFIC ADSORPTION OF TRACE AMOUNTS OF CALCIUM AND STRONTIUM BY HYDROUS OXIDES OF IRON AND ALUMINUM,
Massey Univ., Palmerston North (New Zealand). Dept. of Soil Science.
D. G. Kinniburgh, J. K. Syers, and M. L. Jackson.
Soil Science Society of America Proceedings, Vol. 39, No. 3, p 464-470, May-June 1975. 5 fig, 1 tab, 17 ref.

Descriptors: *Iron, *Aluminum, *Adsorption, Chemical analysis, Chemical reactions, *Oxides, *Calcium, *Strontium, Gels, Sodium compounds, Trace elements.
Identifiers: *Hydrous oxides, *Sodium nitrate.

Freshly prepared Fe and Al hydrous oxide gels and the amorphous product of heating gibbsite selectively adsorbed traces of Ca and Sr from solutions containing a large excess of NaNO3. The fraction of the added Ca (Sr) adsorbed depended principally on the suspension pH, the amount of solid present, and to a lesser extent on the NaNO3 concentration. (Skogerboe-Colo St)
W77-01513

AMMONIA VOLATILIZATION FROM SURFACE APPLICATIONS OF AMMONIUM COMPOUNDS ON CALCAREOUS SOILS: IV. EFFECT OF CALCIUM CARBONATE CONTENT,
Texas A and M Univ., El Paso. Agricultureal Research Station.
L. B. Fenn, and D. E. Kissel.
Soil Science Society of America Proceedings, Vol. 39, No. 4, p 631-633, July-August 1975. 2 fig, 2 tab, 9 r.

Descriptors: *Ammonia, *Calcium carbonate, *Nitrogen, *Fertilizers, *Fertilization, Soil, Water pollution sources, *Soil chemistry, Soil analysis.
Identifiers: *Ammonia volatilization, *Ammonia-nitrate.

The purpose of this study was to determine the effect of soil CaCO3 content on ammonia volatilization from surface applied ammonium compounds. Ammonia-nitrogen losses from surface-applied (NH4)2SO4 increased rapidly to 6.1% soil CaCO3, with slight NH3 loss increases from 6.1 to 9.7% soil CaCO3, and no NH3 loss increase beyond 9.7% soil CaCO3. Ammonium nitrate reached maximum NH3-N loss at 1.3% soil CaCO3 and 110 kg NH4+-N/ha, with lower but still increasing losses of NH3-N at 6.1% soil CaCO3 and 550 kg NH4+-N/ha. (Skogerboe-Colo St)
W77-01515

CONVENTIONAL AND CONTROLLED-RELEASE NITROGEN SOURCES FOR RICE,
Arkansas Agricultural Experiment Station, Stuttgart. Rice Branch Experiment Station.
For primary bibliographic entry see Field 3F.
W77-01516

INTERACTIONS OF BEEF CATTLE WASTES WITH SOIL,
For primary bibliographic entry see Field 5B.
W77-01539

2H. Lakes

FUTURE CHEMICAL COMPOSITION OF THE GREAT SALT LAKE BRINES.
Brigham Young Univ., Provo, Utah.
J. M. Glassett, and P. J. Smith.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-260 505, Price codes: A09 in paper copy, A01 in microfiche. Completion Report, August 1976. 168 p, 2 tab, 19 fig, 47 ref, 8 append. OWRT B-126-UTAH(1). 14-34-0001-6124.

Descriptors: *Brines, *Salinity, *Mathematical models, *Specific gravity, Saline lakes, Saltation, Diffusion, Mixing, Planning, Hydrology, *Great Salt Lake, *Utah, Bridges, Forecasting, Salt balance, Lakes, Water balance, Culverts, Chemistry.
Identifiers: Railroad causeway, Culvert flows, Causeway flows.

A fifteen mile long rock and gravel railroad causeway was completed across Great Salt Lake in 1959 dividing the lake into north and south arms. This causeway has resulted in drastic hydrological changes within the lake. Past predictions of the future salinity of the Great Salt Lake brines have been largely empirical extrapolations. This study developed a theoretical mathematical model to more accurately predict the specific gravity of the upper south arm brine for any year or lake elevation. The basic parameters which were modeled include: (1) the overall salt and water balances, (2) the diffusion and mixing of salts from the dense lower layer of the south arm of the lake into the more dilute upper layer, (3) the two directional flows of brine through the culverts which breach the causeway, and (4) the two directional flows through the permeable causeway fill. Results show that the specific gravity of the upper south arm brine is reaching a steady state situation in which its salinity will remain constant with time.
W77-01053

SHORELAND REGULATION IN WISCONSIN,
Wisconsin Dept. of Natural Resources, Madison.
For primary bibliographic entry see Field 6E.
W77-01087

A CLIMATONOMIC STUDY OF THE LAKE ONTARIO DRAINAGE BASIN,
California Univ., Berkeley, Dept. of Geography.
O. Granger.
Water Resources Research, Vol. 12, No. 4, p 751-761, August 1976. 6 fig, 6 tab, 30 ref.

Descriptors: *Runoff, Lake Ontario, *Streamflow, *Model studies, *Evapotranspiration, Drainage area, Seasonal, Equations, Moisture, Energy, Evaporation, Watersheds(Basins), *Climatology.
Identifiers: *Lake Ontario basin, *Climatonomic study, Monthly runoff, Moisture level, Stored moisture change, Moisture regimes.

An evapotranspiration climatology model was applied to the Lake Ontario drainage basin and to subbasins within it. The model was based on the model of Lettau and Baradas (1973) and was designed to compute monthly runoff, actual evapotranspiration, exchangeable moisture level and stored moisture change, and incorporated seasonally varying parameter values. The model was refined and improved by using a 'direct search' optimization technique (Rosenbrock, 1960) to obtain monthly values of the set of prescribed parameters, which were calibrated using data for 1969-1971 inclusive and for long-term means. The parameters were then applied to relevant 1972 data as an independent test of the validity of the model. The results were consistent and reasonably reliable by comparison with others. The parameter values were physically justifiable and in accord with comparable parameter values reported in the literature. Computed monthly runoffs were within 1.4% of observed streamflow in the unregulated subbasins and within 6.0% in a subbasin that was regulated. For the Lake Ontario basin as a whole, computed monthly runoff was within 7.0% of measured outflow adjusted for lake level changes. The agreement was within 3.5% in the case of annual values. Computed monthly actual evapotranspiration was in excellent agreement with other studies. It was concluded that the model, with a calibrated set of seasonally varying parameter values, was a viable approach for the study of the moisture regimes of catchments. (Roberts-ISWS)
W77-01146

PRELIMINARY ESTIMATION OF COLD WATER AVAILABILITY IN LAKES FOR FISH HATCHERIES,
MacLaren (James F.) Ltd., Willowdale (Ontario). Hydrotechnical Div.
G. Balachandran, P. E. Wisner, and H. S. Belore.
Water Resources Bulletin, Vol. 12, No. 5, p 1041-1048, October 1976. 2 fig, 11 ref.

Descriptors: *Fish hatcheries, *Lakes, *Stratification, *Temperature, *Cold-water fish, *Water availability, *Estimating, Management, Water quality, Freshwater, Simulation analysis, Equations, Mathematical models, Systems analysis, Forecasting.
Identifiers: *Thermal models, Water withdrawal rate.

Fish hatcheries for cold water species (e.g., salmonids) require water below a certain specified optimum temperature. Deep lakes and reservoirs, which are thermally stratified, will have cold water below the thermocline suitable for fish hatchery supplies. Proper management will require withdrawal of water at different depths and a mixture of correct proportions can yield water at desired temperatures and quality. For preliminary studies, a mathematical model can be used to show by a comparatively simple computation the effect of different withdrawal rates of cold water and to check if the situation is critical. A critical situation may warrant the application of sophisticated computer models and/or the use of chilling at the hatchery. The method is illustrated by a case study for a small lake in the Province of Nova Scotia. (Bell-Cornell)
W77-01168

IFYGL RAWINSONDE DATA ACQUISITION SYSTEM,
National Oceanic and Atmospheric Administration, Ann Arbor, Mich. Great Lakes Environmental Research Lab.
C. J. Callahan, J. A. W. McCulloch, E. J. Aubert, and E. M. Rasmusson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-250 968, Price codes: A03 in paper copy, A01 in microfiche.
IFYGL Technical Manual Series No. 6, January 1976. 42 p, 13 fig, 14 tab, 13 ref.

Descriptors: *Remote sensing, *Meteorological data, *Great Lakes, *Atmosphere, Winds, Pressure, Atmospheric pressure, Temperature, Air temperature, Humidity, Sites, Operation and maintenance, Equipment, Data processing, Weather data, Meteorology, International Hydrological Decade.
Identifiers: *International Field Year for the Great Lakes, *Rawinsondes.

Early in the planning stages of IFYGL, in 1967, substantial interest developed in the general topic of lake meteorology and evaporation. The Boundary Layer, the Terrestrial Water Balance, and the Energy Balance Panels were involved in calculations whose accuracy could be improved by a denser network of upper air stations than was normally operated by the United States and Canadian governments. A study of previous network augmentations and the results of three feasibility studies conducted by the Canadian Atmospheric Environment Service were integrated. This evaluation indicated a reasonable probability of obtaining useful weekly-to-monthly estimates of lake evaporation with a network of six to eight LORAN-C rawinsonde stations around the lake, and a high probability of obtaining a unique set of high-quality, high-resolution data from these same stations for use in other studies. The decision was made, therefore, to conduct an IFYGL rawinsonde program. This report on the IFYGL Rawinsonde Data Acquisition System had two major objectives: (1) to provide data users with descriptions of the equipment, techniques, and procedures used in collecting the data, and of data characteristics, and (2) to provide investigators planning similar programs in the future with operational details on capability, performance, and cost factors as an aid in planning, logistics, and decision making. (Sims-ISWS)
W77-01189

EFFECTS OF THE COOLING WATER DISCHARGE ON THE MACROINVERTEBRATES AND FISH POPULATIONS AROUND FLEVO POWER STATION,
For primary bibliographic entry see Field 5C.
W77-01245

LOWER GREEN BAY. AN EVALUATION OF EXISTING AND HISTORICAL CONDITIONS,
Wisconsin Dept. of Natural Resources, Madison.
For primary bibliographic entry see Field 5C.
W77-01287

THE NUTRITION OF GREAT LAKES CLADOPHORA,
Wisconsin Univ., Madison. Water Resources Center.
For primary bibliographic entry see Field 5C.
W77-01288

GUIDELINES FOR LAKE WATERSHED MANAGEMENT PLANNING.
Maine Dept. of Environmental Protection, Augusta. Bureau of Water Quality Control.
For primary bibliographic entry see Field 5G.
W77-01291

COFFEE POND WATERSHED MANAGEMENT PLAN.
Maine Dept. of Environmental Protection, Augusta. Bureau of Water Quality Control.
For primary bibliographic entry see Field 5G.
W77-01292

FOREST LAKE WATERSHED MANAGEMENT PLAN.
Maine Dept. of Environmental Protection, Augusta. Bureau of Water Quality.
For primary bibliographic entry see Field 5G.
W77-01293

RESOURCE INVENTORY MANAGEMENT PLANNING SYSTEM (RIMPS). USER MANUAL,
Jordan (Edward C.), Inc., Portland, Maine.
For primary bibliographic entry see Field 5G.
W77-01294

THE ORIGIN OF SOUTHERN AFRICAN COASTAL LAKES,
Rhodes Univ., Grahamstown (South Africa). Inst. of Freshwater Studies; and Rhodes Univ., Grahamstown (South Africa). Dept. of Zoology and Entomology.
B. J. Hill.
Trans. roy. Soc. S. Afr., Vol. 41, Part 3, p 225-240, (1975). 9 fig, 18 ref.

Descriptors: *Lake morphometry, Bathymetry, *Lake stages, *Africa, *Lakes.
Identifiers: South Africa, Natal, Zululand, Mocambique, *Coastal lakes(Africa).

There are two groups of southern African lakes, a southern group made up of the Wilderness lakes and a north-eastern group comprising lake on the Natal, Zululand and southern Mocambique coastal plain. Bathymetric maps are presented for representative lakes of these two series. There appear to be three types of lakes with respect to origin. Most of the lakes represent drowned valleys associated with river systems. Evidence is presented to show that St Lucia, although 1 to 2 m deep at present, was originally much deeper. The narrow coastal lakes of southern Mocambique are interpreted as low-lying land inundated as a result of rise in sea-level. The third type of lake is typified by Rondevlei at Wilderness, this lake apparently originated as a deflation basin. (South Africa)
W77-01356

A PRELIMINARY TROPHIC STATUS CLASSIFICATION OF SOME SOUTH AFRICAN IMPOUNDMENTS,
National Inst. for Water Research, Pretoria (South Africa).
For primary bibliographic entry see Field 5C.
W77-01363

SURVEY OF MGOBEZELENI LAKE-SYSTEM IN ZULULAND, WITH A NOTE ON THE EFFECT OF A BRIDGE ON THE MANGROVE SWAMP,
Institute for Freshwater Studies, Ubombo (South Africa). Lake Sibaya Research Station.
M. N. Bruton, and C. C. Appleton.
Trans. Roy. Soc. S. Afr., Vol 41 (3), p 283-294, (1975). 4 fig, 2 tab, 17 ref.

Descriptors: *Lakes, Mollusks, Crustaceans, Fish populations, Bridges, Mangrove swamps, *Biota, Water level, Salinity, Limnology, Environmental impact, Africa.
Identifiers: South Africa, *Mgobezeleni lake, *Zululand, Natal, Decapoda.

The Mgobezeleni lake-system in Zululand is described and a checklist of decapod crustacea, molluscs and fish presented. The biota consists of freshwater, estuarine and marine forms. Several uncommon or rare species were found. The effect of various man-made changes on the system is assessed, with particular reference to the mangrove community. Constantly high water levels and excess fresh water have decimated the Bruguieria gymnorhiza forest and associated fauna respectively. (South Africa)
W77-01380

THE LIMNOLOGY OF LAGOA POELELA,
Rhodes Univ., Grahamstown (South Africa). Inst. of Freshwater Studies: and Rhodes Univ., Grahamstown (South Africa). Dept. of Zoology and Entomology.
B. J. Hill, S. J. M. Blaber, and R. E. Boltt.
Trans. Roy. Soc. S. Afr., Vol 41 (3), p 263-271, (1975). 2 fig, 3 tab, 15 ref.

Descriptors: *Limnology, Salinity, Water temperature, Dissolved oxygen, Light penetration, Lakes, Aquatic weeds, Sodium, Fish populations, Brackish water, Physicochemical properties, Africa, Tilapia.
Identifiers: *Lagoa Poelela, *Mozambique, Southern Africa, Potamogeton pectinatus, Naias, Chara.

The limnology of Lagoa Poelela in southern Mozambique was investigated in July 1973. This lake is connected to the sea via a 75 km long channel, the area is 65 km2, it has a mean depth of 13,7m and a maximum depth of 24 m. The water was saline (8 degree/00) and the major ions, with the exception of sodium, were in the proportions expected of diluted sea water. The concentration of sodium was twice as high as expected; this sodium enrichment has been found in other coastal lakes. Temperatures were relatively uniform from the surface to the bottom and the oxygen saturation at 20 m was 80% of the surface value. Light penetration was higher than for other southern African lakes and at 22 m was 3% of surface illumination. Aquatic macrophytes were absent from shallow water in the main lake, only being found deeper than 3 metres where Potamogeton pectinatus and Naias marina were common. Naias was found to a depth of 10 m and Chara sp. to 12 m. Only 11 species of fish were found. The fish population was dominated by the cichlids Tilapia rendalli and T. mossambica although some estuarine species were also found. It is suggested that the domination of this brackish lake by cichlids reflects a general tendency for cichlids to increase in numbers in estuarine systems which become isolated from the sea. (South Africa)
W77-01381

THE EUTROPHICATION LEVELS OF SOME SOUTH AFRICAN IMPOUNDMENTS. I. RIETVLEI DAM,
National Inst. for Water Research, Pretoria (South Africa).
For primary bibliographic entry see Field 5C.
W77-01391

EUTROPHICATION LEVELS OF SOME SOUTH AFRICAN IMPOUNDMENTS. II. HARTBEESPOORT DAM,
National Inst. for Water Research, Pretoria (South Africa).
For primary bibliographic entry see Field 5C.
W77-01392

LIMNOLOGICAL DATA REPORT FOR THE MAINE DEPARTMENT OF ENVIRONMENTAL PROTECTION--U. S. GEOLOGICAL SURVEY COOPERATIVE LAKE STUDIES PROJECT,
Geological Survey, Augusta, Maine.
D. J. Cowing, and M. Scott.
Open-file report, June 1976. 168 p, 1 fig, 3 tab, 23 ref.

Descriptors: *Maine, *Lakes, *Water chemistry, *Lake morphology, *Limnology, Water analysis,

Chemical analysis, Biological properties, Phytoplankton, Zooplankton, Benthos, Water temperature, Thermal stratification.

Physical, chemial, and biological data collected during the 1975 calendar year are presented for 43 Maine lakes. Methods for the collection and analysis of the hydrologic data are outlined. Physical characteristics include drainage area, surface area, surface elevation, volume, maximum depth, mean depth, epilimnion depth, epilimnion volume, and length of shoreline. Water-quality analyses are listed for up to 27 parameters on the lake-sample sites and 5 parameters on flowing tributaries. Biological analyses include phytoplankton data for 4 lakes, zooplankton data for 4 lakes, benthic macroinvertebrate data for 25 lakes, and bacterial data for lake tributaries. (Woodard-USGS)
W77-01414

ANNOTATED BIBLIOGRAPHY OF THE LAKES, PONDS, AND RESERVOIRS OF NEW YORK STATE THROUGH 1974 (EXCLUSIVE OF LAKES ERIE AND ONTARIO),
Geological Survey, Albany, N.Y.
P. E. Greeson, G. K. Schultz, and P. A. Vopelak.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-256-408, Price codes: A16 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 76-55, July 1976. 360 p.

Descriptors: *Bibliographies, *Abstracts, *Publications, *Limnology, *New York, Lakes, Ponds, Reservoirs, Documentation, Information retrieval.

More than 1,200 titles and abstracts of limnological studies of ponds, reservoirs, and lakes in New York (excluding Lakes Erie and Ontario) are compiled in one volume. Publications cited date from the late 19th century through 1974. Titles and abstracts are presented alphabetically by author's name; cross indexes of coauthors, locations, and subjects are also provided. Author's abstracts were used if available; the remainder were written by the compilers of this volume and are so designated. Some of the publications cited could not be obtained for review; they are given complete reference but have no accompanying abstract. This compilation is an exhaustive index to limnological studies within the State. It is intended for use mainly by those concerned with water-use planning, water management, and lake ecology. (Woodard-USGS)
W77-01418

THE BENTHOS OF SOME SOUTHERN AFRICAN LAKES PART 3: THE BENTHIC FAUNA OF LAKE NHLANGE, KWAZULU, SOUTH AFRICA,
Rhodes Univ., Grahamstown (South Africa). Dept. of Zoology and Entomology; and Rhodes Univ., Grahamstown (South Africa). Inst. of Freshwater Studies.
R. E. Boltt, and B. R. Allanson.
Trans. roy. Soc. S. Afr., Vol 41 (3), p 241-262, (1975). 13 fig, 9 tab, 27 ref.

Descriptors: *Benthos, *Benthic fauna, *Salinity, Peat, Detritus, Decomposing organic matter, Floods, *Dissolved oxygen, Seasonal, Oxygen, Mud-water interfaces, Standing stock, Dominant organisms, Water level fluctuations, Substrates, Aquatic insects, Lakes, Physicochemical properties, Water depth, Crustacea, Annelids, Coelenterata, Nematoda, Mollusks, Oxygen demand, Africa.
Identifiers: *Lake Nhlange, *South Africa, Oxygen depletion.

Lake Nhlange (KwaZulu, South Africa) is connected to the sea through the Kosi estuary and has a salinity between 36 degrees/oo and 5 degrees/oo. The benthos of the lake was sampled at approximately six-monthly intervals from July 1965 to January 1969. The substrates are mainly sandy in shallow water and also on steeply sloping profiles even in the deepest water of 30 m. Flat areas are mainly silty. In December 1965, following the closure of the estuary mouth and severe rains, the lake level rose to about 2 m above its normal level. Although the salinity changed little (5 degrees/oo to 3 degrees/oo), quantities of peat-stained water and detritus were brought into the lake. A waning pattern of low oxygen conditions below about 12 m in the hot season, followed by reasonably well-oxygenated conditions in the cold season, was found. Particularly severe oxygen depletions were discovered at the mud water interface, even where well-oxygenated conditions pertained in the open water column at equivalent depths. Evidence that the fauna was driven into shallower waters by the influx of detritus, with its high oxygen demand, is given and a slow recolonization of the deeper water is shown. (See also W77-01438 and W77-01439) (South Africa)
W77-01437

THE BENTHOS OF SOME SOUTHERN AFRICAN LAKES PART 4: THE BENTHOS OF LAGOA POELELA,
Rhodes Univ., Grahamstown (South Africa). Dept. of Zoology and Entomology; and Rhodes Univ., Grahamstown (South Africa). Inst. of Freshwater Studies.
R. E. Boltt.
Trans. Roy. Soc. S. Afr., Vol 41(3), p 273-281, (1975). 4 tab, 8 ref.

Descriptors: *Benthos, *Vertical distribution, *Benthic fauna, Dominant organisms, Zooplankton, Lakes, Standing stock, Biomass, Submerged plants, Species abundance, Africa.
Identifiers: Pontogeloides latipes, *South Africa, *Mozambique, *Lagoa Poelela, Musculus virgilius, Chara, Grandidierella bonnieri.

The benthos of Lagoa Poelela (Mozambique) was sampled in July 1973 with a Van Veen grab. The substrates of the lake were sandy between 0 m and about 3 m. Thereafter sand and silt were common to about 9 m and mainly pure silt below this depth. The benthos was mainly distributed between 0 and about 12 m, with very little below that depth. The faunal list comprises 19 taxa of which only nine can be classed as truly dominant benthic organisms, the remainder being only either planktonic forms with brief sojourns in the benthos or uncommon. Three forms dominate the standing stock biomass. Musculus virgilius associated with Chara between 5 and 2 m has a biomass of 2,307 g m-2. Grandidierella bonnieri has a biomass of 0,213 g m-2 between 0 and 3 m and 0,143 between 5 and 12 m. Pontogeloides latipes is most abundant in 0-3 m with a standing stock of 0.172 g m-2. It is argued that this lake may develop either a thermocline or a halocline or both during summer, and hence the very low biomass of 0,007 g m-2, below 12 m. (See also W77-01437 and W77-01439) (South Africa)
W77-01438

THE BENTHOS OF SOME SOUTHERN AFRICAN LAKES PART 5: THE RECOVERY OF THE BENTHIC FAUNA OF ST LUCIA LAKE FOLLOWING A PERIOD OF EXCESSIVELY HIGH SALINITY,
Rhodes Univ., Grahamstown (South Africa). Dept. of Zoology and Entomology; and Rhodes Univ., Grahamstown (South Africa). Inst. of Freshwater Studies.
R. E. Boltt.
Trans. Roy. Soc. S. Afr., Vol 41 (3), p 295-323, (1975). 6 fig, 11 tab, 11 ref, append.

Descriptors: *Benthos, *Benthic fauna, *Salinity, Aquatic insects, *Salt tolerance, Ostracoda, Zooplankton, Gravimetric analysis, Numerical analysis, Standing stock, Dominant organisms, Food abundance, Diptera, Africa.
Identifiers: *St Lucia Lake, *Zululand, Natal, *South Africa, Assiminea bifasciata, Polypedilum.

St. Lucia Lakes (Zululand, South Africa) were sampled with a Van Veen grab in January 1972, July 1972, and January 1973. The system had high salinities at the commencement of the programme (70 degrees/oo-80 degrees/oo False Bay, 55 degrees/oo-60 degrees/oo North Lake, 45 degrees/oo-58 degrees/oo South Lake) which quickly dropped to less than sea-water values in the first six months. The January 1972 samples showed that only a few Polypedilum (Chironomidae) survived in False Bay, while a very reduced faunal list was shown for North Lake (9 sp.). Nevertheless South Lake showed a fairly complete faunal list (21 sp.). By July 1972 nine species were recovered in False Bay, 18 in North Lake and 23 in South Lake, indicating reinvasion consequent upon dilution of the salts in the water. No great change was shown by the result of the January 1973 samples. Evidence suggests that most forms would tolerate salinities up to about 55 degrees/oo salinity. Beyond this level only Chironomid larvae and Ostracods survived. Most rapid reinvasion of the denuded parts of the system was by rapidly maturing forms with planktonic larvae. There is evidence of exchanges of water between the various areas consequent upon wind induced seiches which would carry the planktonic larvae to these denuded areas. (See also W77-01437 and W77-01438) (South Africa)
W77-01439

METAL ENRICHMENT OF SEDIMENTS IN INLAND WATERS - THE HARTBEESPOORT DAM,
Pretoria Univ. (South Africa). Dept. of Chemistry.
For primary bibliographic entry see Field 5A.
W77-01487

THE LIMNOLOGICAL INVESTIGATIONS OF REICOTOPS AND PHENOMENON OF CURRENT TRAVERTINISATION IN PLITVICKA JEZERA (PLITVICE LAKES, YUGOSLAVIA), (IN SERBO-CROATIAN),
I. Matonickin, Z. Pavletic, V. Tavcar, and N. Krkac.
Prirodosl Istraz Acta Biol. 40, p 5-68, 1971.

Descriptors: *Inflow, *Karst, *Karst hydrology, *Water types, Biological communities, Running waters, Alkalinity, Hardness(Water), *Travertine, Limestones, *Mosses, Lakes.
Identifiers: Cinclidotus aquaticus, Cratoneurum commutatum, Didymodon tophaceus, Platyhpnidium rusciforme, *Reicotops, *Yugoslavia(Plitvice Lakes).

Exceptional hydrological conditions such as a large influx of water and karstic terrain have produced unique ecological conditions in the running water biotopes of this area. The waters have high alkalinity and bicarbonate hardness. The complex of living communities in the Plitvice Lakes is very distinct and depends on ecological factors and the degree of development of travertine forms. These communities are briefly described and their flora and fauna discussed. Mosses such as Cinclidotus aquaticus, Platyhypnidium rusciforme, Cratoneurum commutatum and Didymodon tophaceus may, depending on the temperature, actively build travertine layers.–
Copyright 1975, Biological Abstracts, Inc.
W77-01540

LARVAL CONTRACAECUM (NEMATODA, ANISKIDAE) IN THE PERICARDIUM OF FISHES FROM EAST AFRICAN LAKES,
Hebrew Univ., Jerusalem (Israel). Heinz Steinitz Marine Biology Lab.
For primary bibliographic entry see Field 5C.
W77-01545

BIOLOGY OF JUVENILE BREAM IN THE MINGECHAUR RESERVOIR, (IN RUSSIAN),
L. V. Strazhnikova.

Izv Akad Nauk Az SSR Ser Biol Nauk. 4, p 89-91, 1974.

Descriptors: Rivers, Reservoirs, *Fish, *Growth rates, *Juveniles, *Fish biology.
Identifiers: Azerbaijan-SSR, *Bream, *Mingechaur, Reservoir(USSR).

The growth rate of juvenile bream in the Mingechaur Reservoir on the Kura River in the Azerbaijan SSR (USSR) has accelerated slightly in the 1st years since the reservoir opened in 1953. In comparison with other bodies of water the growth rate of juveniles is slightly lower and there is a lag in the ponderal index. The ponderal index of the juveniles changes little during the year, apparently because of abundant food.--Copyright 1975, Biological Abstracts, Inc.
W77-01546

2I. Water In Plants

WATER SUPPLY CATCHMENT HYDROLOGY RESEARCH: THE WALLABY CREEK FOG DRIP STUDY,
Melbourne and Metropolitan Board of Works (Australia). Hydrological studies Section.
M. J. O'Connell, and P. J. O'Shaughnessy.
Melbourne and Metropolitan Board of Works Reports No. MMBW-W-004, May 1975. 38 p. 8 fig., 8 tables, 7 ref., 3 append.

Descriptors: *Fog, *Forest watersheds, *Interception, *Australia, Vegetation effects, Water yield, Age, Forests, Water supply, Precipitation(Atmospheric).
Identifiers: *Eucalyptus-regnans, *Wallaby Creek(Vic), *Fog drip.

A study is reported which aimed to measure fog drip and assess its importance as a source of precipitation under mountain ash forest (Eucalyptus regnans), and to determine the effect of forest age on the magnitude of fog drip. Two plots, each 40 metre square were set up under different aged stands of mountain ash, and equipped with recording rain gauges, which were relocated at random every week. A further recording rain gauge was placed at a fixed location in a clearing. Fog drip was determined by comparing the precipitation records under the forest with that in the open. Over a four-year period, it was concluded that fog drip under the forest was less than one percent of gross precipitation in the open, and that there was no significant effect of forest age on fog drip. (CSIRO)
W77-01070

WATER TRANSPORT IN THE SOIL-ROOT SYSTEM: TRANSIENT ANALYSIS,
Auburn Univ., Ala. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2G.
W77-01147

GROWTH OF THE YELLOWCHEEK ELOPICHTHYS BAMBUSA (RICH.) IN THE AMUR BASIN, (IN RUSSIAN),
Tikhookeanskii Nauchno-Issledovatelskii Institut Rybnogo Khozyaistva i Okeanografii, Khabarovsk (USSR). Lab. of Freshwater Fish.
M. L. Krychtin.
Vopr Ikhtiol. 15(1), p 101-108, 1975.

Descriptors: *Fish, Carnivores, *Growth rates.
Identifiers: *Amur Basin(USSR), Elopichthys-Bambusa, USSR, *Yellow-Cheek, Pelagic fish.

The yellow-cheek E. bambusa is a large carnivorous pelagic fish having high meat qualities. In the Amur basin (USSR) it has a comparatively high rate of growth and weight gain. The females grow more rapidly than the males and the difference in growth between them increases steadily with age. The yellow-cheek population in the Amur basin at an age of 10-12 yr reaches an average length of 100-110 cm and weight of 10-14 kg.--Copyright 1975, Biological Abstracts, Inc.
W77-01229

SOIL NITRATE LOSS DURING IRRIGATION: ENHANCEMENT BY PLANT ROOTS,
California Univ., Berkeley, Coll. of Natural Resources.
For primary bibliographic entry see Field 3F.
W77-01268

LEAF WATER POTENTIAL AND STOMATAL ACTIVITY IN SORGHUM AS INFLUENCED BY SOIL MOISTURE STRESS,
Nebraska Univ., Lincoln. Dept. of Horticulture and Forestry.
A. Blum, and C. Y. Sullivan.
Israel Journal of Botany, Vol 23, p 14-19, 1974. 4 fig, 15 ref.

Descriptors: *Sorghum, *Moisture stress, *Soil-water-plant relationships, *Soil moisture, *Leaves, Stomata, Crops, Drying, Transpiration, Droughts, Cereal crops, Wetting, Growth chambers, Diffusion.

Five sorghum varieties were grown in soil in a growth chamber and submitted to two consecutive soil drying cycles separated by a three day recovery period. During each drying cycle measurements were made on stomatal pore width, leaf diffusion resistance, leaf water potential and soil water potential. The water relations of sorghum plants differed greatly between the two drying cycles. A major effect of the first drying cycle on plant response to stress during the second drying cycle was a markedly reduced response of stomotal aperture to change in leaf water stress, thus confirming previous research findings. A second effect concerned relations between soil water potential and leaf water potential. As soil water potential decreased, plants in the second cycle maintained a higher (less negative) leaf water potential than in the first drying cycle. A previous drought may reduce the soil-to-leaf water potential gradient developed along the recovered plant, and thus imply increased adaptation to soil moisture stress, or a hardening effect. (Jamail-Arizona)
W77-01276

SOIL MOISTURE USE BY VELVET MESQUITE (PROSOPIS JULIFLORA),
Arizona Univ., Tucson. School of Renewable Natural Resources.
For primary bibliographic entry see Field 2G.
W77-01283

RESPONSE OF WHEAT UNDER SUB-HUMID IRRIGATED CONDITIONS TO ATMOSPHERIC MISTING DURING GRAIN FILLING,
International Maize and Wheat Improvement Centre, Londres (Mexico).
For primary bibliographic entry see Field 3F.
W77-01284

THE EFFECT OF ENVIRONMENTAL FACTORS ON THE GROWTH OF A NATURAL PASTURE,
Hebrew Univ., Jerusalem (Israel). Dept. of Botany.
D. Wallach.
Agricultural Meteorology, Vol. 15, p 231-244, 1975. 6 fig, 2 tab, 16 ref.

Descriptors: *Mathematical models, *Growth rates, *Environmental effects, *Soil moisture, Semiarid climates, Biomass, Least squares method, Temperature, Pastures, Evapotranspiration, Soil horizons, Moisture content.
Identifiers: *Negev region(Israel).

Using a semi-empirical approach, growth curves are analyzed for three years for a natural pasture at the Migda Experimental farm in the Negev region of Israel. To study the dependence of the growth curves on environmental factors, logistic equations in which the growth rate R is a function of soil moisture or temperature have been used. The parameters that appear are optimized by a non-linear least-squares technique. Soil moisture is an important variable. Temperature alone is of no predictive value, but temperature in conjunction with soil moisture is of marginal importance. The results are quite insensitive to the different measures of soil moisture and temperature considered. The fit to the data when R is a function of both soil moisture and temperature is still not fully satisfactory. It seems that semi-empirical equations can profitably be used to investigate specific aspects of crop growth, those dealing with environment interactions. It remains to be seen whether it is possible to find simple equations which would be fully adequate as predictive tools. (Jamail-Arizona)
W77-01285

SIMULATION OF EVAPOTRANSPIRATION AND DRAINAGE FROM MATURE AND CLEAR-CUT DECIDUOUS FORESTS AND YOUNG PINE PLANTATION,
Forest Service (USDA), Franklin, N.C. Coweeta Hydrologic Lab.
For primary bibliographic entry see Field 2D.
W77-01424

ESTIMATING WATER YIELD DIFFERENCES BETWEEN HARDWOOD AND PINE FORESTS: AN APPLICATION OF NET PRECIPITATION DATA,
Forest Service (USDA), Grand Rapids, Minn. North Central Forest Experiment Station.
For primary bibliographic entry see Field 3B.
W77-01425

BIOLOGY OF THE SNAKEHEAD IN THE SYR DARYA BASIN, (IN RUSSIAN),
G. M. Dukravets, and A. I. Machulin.
Izv Akad Nauk Kaz SSR Ser Biol. 6, p 40-42, 1974.

Descriptors: Fish, *Fish populations, Rivers, Biology.
Identifiers: Ophiocephalus-argus-warpachowskii, *Snakehead, *Syr-darya River, *USSR, Uzbek-SSR.

The Amur snakehead Ophiocephalus argus warpachowskii entered a basin of the Syr Darya River in the early 1960's while herbivorous fishes were being hauled to pond fisheries of the Uzbek SSR (USSR). By 1964 it had spread to the lower reaches of the river and at present has firmly colonized the entire basin of the Syr Darya and estuarine parts of the Aral Sea. Data are presented on the size, age, growth, fecundity, reproduction and feeding of the snakehead in lakes of the lower reaches of the Syr Darya. Its growth has slowed slightly, fecundity has increased, the diet has expanded and the character of sexual maturation is undergoing changes toward single spawning.--Copyright 1975, Biological Abstracts, Inc.
W77-01427

SOME AQUATIC VERTEBRATES FROM THE NAMIB DESERT, SOUTH WEST AFRICA,
South West Africa Administration, Windhoek. Div. of Nature Conservation and Tourism.
J. E. W. Dixon, and M. J. Blom.
Madoqua, Series II, Vol 3 (69-73), p. 31-32, (1974).

Descriptors: *Fish populations, Freshwater fish, *Africa, Deserts, Tilapia, Carp, *Distribution, Fish stocking, Fisheries, Ponds.
Identifiers: *South West Africa, *Namib Desert, Tilapia mossambica, Barbus anoplus, Hepsetia breviceps, Pyxicephalus delalandei, Bream.

The occurrence of the bream Tilapia mossambica Peters from pools in the Namib Desert is documented. The aquatic vertebrates Cyprinus carpio, Barbus anoplus. Hepsetia breviceps and Pyxicephalus delalandei are also listed. The origin and dispersal of T. mossambica stock in South West Africa is discussed. Amongst established freshwater fish populations many individuals show signs of malnutrition. (South Africa)
W77-01493

THE INFLUENCE OF SOIL MOISTURE AFTER PLANTING ON THE GROWTH AND DIFFERENTIATION OF THE PEDUNCULATE OAK (QUERCUS PEDUNCULATA EHRH. VAR. TARDIFLORA CZER, (IN BULGARIAN),
Forest Research Inst., Sofia (Bulgaria).
K. D. Kostov, and T. Naydenova-Yaneva.
Gorsko Stop Nauka. 11(2), p 9-13, 1974.

Descriptors: *Soil-water-plant relationships, *Soil moisture, *Plant growth, *Oak trees, *Growth rates.
Identifiers: Quercus-pedunculata-var-tardiflora.

Seedlings were subjected to the effect of varying degrees of soil moisture (100, 85, 70, 55, 40 and 25% of the maximum water-holding capacity). The moisture degree in the separate treatments was maintained in the 1st yr after planting, while during the next 4 yr conditions were similar and soil moisture in all treatments was about 85% of the maximum waterholding capacity. The drought in the 1st yr after planting had affected the growth of the greater part of the young seedlings. After the water regimen of the soil was improved, the differentiation of the seedlings became more marked, especially those that were grown at 40 and 25% of the soil moisture in the 1st yr. The ratio was lowest between the weight of the root system and the weight of seedlings (2.3), grown at 100% of the maximum waterholding capacity of the soil, and the highest (4.9) in those that were grown at a moisture of 55% of the maximum waterholding capacity of the soil.--Copyright 1975, Biological Abstracts, Inc.
W77-01498

WATER-RETAINING CAPACITY OF THE ROOTS OF SEVERAL FOREST TREE SPECIES, (IN BULGARIAN),
Oak Forest Experiment Station, Burgas (Bulgaria).
Y. Manolova, and I. Palashev.
Gorsko Stop Nauka. 11(2), p 14-19, 1974.

Descriptors: *Trees, *Forests, *Root systems, *Water storage, Drought tolerance, Deciduous trees, Coniferous trees, Pine trees, Douglas fir trees.
Identifiers: Fagus-orientalis, Picea-excelsa, Populus-deltoides, Pseudotsuga-douglas, Quercus-spp, Sorbus-torminalis, Tilia-argentea.

The skeletal roots of certain coniferous and deciduous species, which grow in plantations and in natural forest stands in the area of the Strandja Mt., showed considerable differences in relation to their water contents. Of the deciduous species, Populus deltoides Marsh. had the highest water content-208%, followed by Tilia argentea Desf.-120%; the lowest, in Quercus cerris L., Q. pubescens Willd. and Q. rubra L. 45-63%. Q. sessiliflora Salisb., Q. conferta Kit., Sorbus torminalis (L.) Crantz and Fagus orientalis Lipsky had water content ranging 71-78%. In coniferous species, the skeletal roots of Pinus maritima Mill. and P. nigra Arn. have higher water contents (185-192%), as compared with the roots of P. sylvestris L. and Picea excelsa Link.--147-149%. The lowest water content was seen in Pseudotsuga douglas Carr.--122%. The trees have different capacities to retain the water in their skeletal roots under extremely dry conditions. The more drought-resistant species (Quercus sp., Pinus sp.,) evaporate moisture at a slower and more uniform rate, while mesophytic plants (Populus sp., Tilia sp., Fagus sp., Picea sp.) do so more rapidly and more erratically.--Copyright 1975, Biological Abstracts, Inc.
W77-01504

PRECIPITATION OF CALCIUM AND STRONTIUM SULFATES AROUND PLANT ROOTS AND ITS EVALUATION,
Purdue Univ., Lafayette, Ind. Dept. of Agronomy.
G. L. Malzer, and S. A. Barber.
Soil Science Society of America Proceedings, Vol. 39, No. 3, p 492-495, May-June 1975. 2 fig, 2 tab, 8 ref.

Descriptors: *Calcium, *Strontium, *Sulfates, Root system, Chemical precipitation, *Corn(Field), Analytical techniques, Plant physiology.
Identifiers: *Plant roots, Autoradiographic techniques.

The flux of Ca2+, Sr2+, and SO4(2-) to corn roots was investigated to determine if accumulation at the root caused precipitates to form and if so to determine the influence of precipitate formation on Ca and Sr uptake. Autoradiographic techniques using 45Ca and 35S showed both Ca2+ and SO4(2-) accumulated at root surfaces when supply be mass-flow exceeded uptake. Petrographic studies of the roots confirmed the formation of CaSO4 precipitates. (Skogerboe-Colo St)
W77-01514

2J. Erosion and Sedimentation

TOTAL MINERAL DISSOLVED TRANSPORT BY WORLD MAJOR RIVERS,
Paris Univ., Orsay (France). Ecol Normale Superieure; and Paris Univ. (France). Laboratoire de Geologie.
For primary bibliographic entry see Field 5B.
W77-01135

STOCHASTIC CHARACTERISTICS OF SEDIMENT MOTIONS,
Singapore Univ. Dept. of Civil Engineering.
H. F. Cheong, and H. W. Shen.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 102, No HY7, Proceedings Paper No 12269, p 1035-1049, July 1976. 9 fig, 8 ref, 2 append. NSF ENG74-03037.

Descriptors: *Bed load, *Sediment transport, *Correlation analysis, *Statistical methods, *Tracers, Dispersion, Probability, Laboratory tests, Analysis, Sediment discharge, River beds, Radioisotopes, Equations, Radioactivity.
Identifiers: Distribution functions.

The stochastic characteristics of the discrete movements of a sand grain moving as bed load under the action of flowing water were examined. Functional relationships between the step length (or rest duration) distributions and the probability of a sand grain making a specified number of steps (or rest durations) over a distance (or time) were derived and compared with the results from radioactive tracer experiments. A technique for determining the behavior of the density functions for step lengths and rest durations was developed. This technique involved determination of the curvature of the autocorrelation function which was constructed from the step length and rest duration data. (Adams-ISWS)
W77-01140

SUBMARINE MEANDERING THALWEG AND TURBIDITY CURRENT FLOWING FOR 4,000 KM IN THE NORTHWEST ATLANTIC MID-OCEAN CHANNEL, LABRADOR SEA,
McGill Univ., Montreal (Quebec). Dept. of Geological Sciences.
For primary bibliographic entry see Field 2L.
W77-01150

RADIONUCLIDES IN CHESAPEAKE BAY SEDIMENTS,
National Aeronautics and Space Administration, Greenbelt, Md. Goddard Space Flight Center.
For primary bibliographic entry see Field 2L.
W77-01188

GEOMETRY OF RIVER MEANDERS,
University of East Anglia, Norwich (England). School of Environmental Sciences.
For primary bibliographic entry see Field 2E.
W77-01340

NATURAL FILTERING OF SUSPENDED SOIL BY A STREAM AT LOW FLOW,
Forest Service (USDA), Corvallis, Oreg. Pacific Northwest Forest and Range Experiment Station.
For primary bibliographic entry see Field 4C.
W77-01428

STREAMFLOW NITROGEN LOSS FOLLOWING FOREST EROSION CONTROL FERTILIZATION,
Forest Service (USDA), Portland, Oreg. Pacific Northwest Forest and Range Experiment Station.
For primary bibliographic entry see Field 4D.
W77-01431

SEVENTEEN-YEAR SEDIMENT PRODUCTION FROM A SEMIARID WATERSHED IN THE SOUTHWEST,
Forest Service (USDA), Fort Collins, Colo. Rocky Mountain Forest and Range Experiment Station.
For primary bibliographic entry see Field 4D.
W77-01433

METAL ENRICHMENT OF SEDIMENTS IN INLAND WATERS - THE HARTBEESPOORT DAM,
Pretoria Univ. (South Africa). Dept. of Chemistry.
For primary bibliographic entry see Field 5A.
W77-01487

VORTEX VELOCITY PREDICTION WITH EMPHASIS DIRECTED TOWARD VORTEX TUBE SEDIMENT TRAP DESIGN,
Nebraska Univ., Lincoln. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 8B.
W77-01520

2K. Chemical Processes

TOTAL MINERAL DISSOLVED TRANSPORT BY WORLD MAJOR RIVERS,
Paris Univ., Orsay (France). Ecol Normale Superieure; and Paris Univ. (France). Laboratoire de Geologie.
For primary bibliographic entry see Field 5B.
W77-01135

PERCOLATION OF SURFACE-APPLIED WATER IN THE FIELD,
Kentucky Agricultural Experimental Station, Lexington.
For primary bibliographic entry see Field 2G.
W77-01137

COUPLING PHENOMENA IN SATURATED HOMO-IONIC MONTMORILLONITE: I. EXPERIMENTAL,
Guelph Univ. (Ontario). Dept. of Land Resource Science.
For primary bibliographic entry see Field 2G.
W77-01138

NITRATE AND CHLORIDE POLLUTION OF AQUIFERS: A REGIONAL STUDY WITH THE AID OF A SINGLE-CELL MODEL,
Tahal-Water Planning for Israel, Ltd. Tel-Aviv.
For primary bibliographic entry see Field 5B.
W77-01145

THE EFFECT OF PRESSURE ON THE IONIZATION OF BORIC ACID IN SODIUM CHLORIDE AND SEAWATER FROM MOLAL VOLUME DATA AT 0 AND 25 C,
Rosenstiel School of Marine and Atmospheric Sciences, Miami, Fla.
G. K. Ward, and F. J. Millero.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A021 557, Price codes: A02 in paper copy, A01 in microfiche. Geochimica et Cosmochimica Acta, Vol 39, p 1595-1604, 1975. 3 fig, 7 tab, 49 ref.

Descriptors: *Ionization, *Chemical properties, *Pressure, *Sodium chloride, *Sea water, Chemical reactions, Ions, Chemistry, Electrolytes, Boron, Water properties, Inorganic compounds, Physical properties, Water pressure.
Identifiers: *Boric acid, Sodium borate, *Ionizations constants, Chemical equilibrium, *Ionization equilibria, Pressure effects, NaCl, B(OH)3, NaB(OH)4, Nonelectrolytes, Molal volume, Partial molal volume, Boric acid ionization, Temperature effects.

The apparent molal volume of boric acid, B(OH)3, and sodium borate, NaB(OH)4, has been determined in 35,000 mg/l salinity seawater and 0.725 molal NaCl solutions at 0 and 25 C from precise density measurements. Similar to the behavior of nonelectrolytes and electrolytes in pure water, the molal volume of B(OH)3 is a linear function of added molarity. The molal volume of NaB(OH)4 is a linear function of the square root of added molarity in seawater and NaCl solutions. This paper presented results of studies of B(OH)3 in 0.725 molal NaCl solutions. The partial molal volumes of B(OH)3 and NaB(OH)4 in seawater and NaCl were determined from the apparent molal volume by extrapolating to infinite dilution in the medium. The partial molal volume of B(OH)3 was larger in seawater than pure water, apparently due to the ability of electrolytes to dehydrate the nonelectrolyte B(OH)3. The partial molal volume of NaB(OH)4 in itself, NaCl, and seawater was larger than the expected value at 0.725 molal ionic strength due to ion pair formation. The volume change for the ionization of B(OH)3 in NaCl and seawater was determined from the molal volume data. Values of partial molal volumes = -29.2 and -25.9 ml/mol were found in seawater, and partial molal volumes = -21.6 and -26.4 in NaCl, respectively, at 0 and 25 C. The effect of pressure on the ionization of B(OH)3 in NaCl and seawater at 0 and 25 C determined from the volume change was in excellent agreement with direct measurements in artificial seawater (Culberson and Pytkowicz, 1967) and natural seawater (Culberson and Pytkowicz, 1968). (Henley-ISWS)
W77-01190

THE ENVIRONMENTAL CHEMISTRY OF COPPER (II) IN AQUATIC SYSTEMS,
Australian Atomic Energy Commission Research Establishment, Lucas Heights, Div. of Chemical Technology.
For primary bibliographic entry see Field 5B.
W77-01257

THEORETICAL MODEL FOR THE FORMATION OF ION-PAIRS IN SEAWATER,
Rhode Island Univ., Kingston. Graduate School of Oceanography.
D. R. Kester, and R. M. Pytkowicz.
Available from the National Technical Information Service, Springfield, VA 22161 as ADA-021 618, Price code: A02 in paper copy, A01 in microfiche. Marine Chemistry, Vol. 3, p 365-374, 1975. 2 fig, 4 tab, 26 ref. NR 083-102. NSF GA-36057X, ONR N00014-67-A-0369-0007.

Descriptors: *Mathematical models, *Sea water, Theoretical analysis, *Model studies, *Ions, Mathematics, Analytical techniques, Chemical reactions, Electrolytes, Sulfates, Calcium sulfate, Carbonates, Fluorides, chlorides, Oceans, Calcium carbonate, Sodium sulfate.
Identifiers: *Ion-pairs, Ion-pair formation, *Ion-pair models, *Electrostatic, Borate, Sodium fluoride, Sodium carbonate, Sodium bicarbonate, Calcium fluoride.

Predictions of association constants for ion-pair formation in seawater were compared to measured constants as a test for the existence of ion-pairs. A fair agreement was obtained in most cases, although the theoretical electrostatic calculations indicate that significant chloride ion-pairing should occur which has not been observed in most experimental investigations. (Henley-ISWS)
W77-01341

GEOPHYSICAL EXPLORATION FOR POTABLE GROUNDWATER SUPPLIES IN THE KALAHARI GEMSBOK NATIONAL PARK,
Ruker (Richard) and Associates, Bryanston (South Africa).
For primary bibliographic entry see Field 4B.
W77-01366

NUTRIENT RECYCLING AND THE STABILITY OF ECOSYSTEMS: IMPLICATIONS FOR FOREST MANAGEMENT IN THE SOUTHEASTERN U.S.,
Forest Service (USDA), Franklin, N. C. Coweeta Hydrologic Lab.
J. B. Waide, and W. T. Swank.
In: America's Renewable Resource Potential - 1975: The Turning Point, Proceedings, 1975 National Convention, Society of American Foresters, September 28-October 2, 1975, Washington, D. C., Society of American Foresters, Washington, D. C., p. 404-424. 4 fig, 5 tab, 30 ref.

Descriptors: *Nitrogen cycle, *Forest management, *Ecosystems, Productivity, Coniferous forests, Deciduous forests, *Southeast U.S., Nutrients, Recycling, *Cycling nutrients.
Identifiers: Relative stability.

A conceptual framework of elemental cycles was successfully applied to analyses of the nitrogen cycle in deciduous hardwoods and loblolly pine, which are two important southeastern forest ecosystem types. The relative stability of these ecosystems was defined in terms of resistance and resilence, and the impact of alternative levels of tree utilization on subsequent productivity after several rotations was evaluated. Results establish the relevance of ecosystem relative stability to practical mangement problems. (Forest Service)
W77-01420

THE RELATIONSHIP BETWEEN NITRATE CONCENTRATIONS IN THE SOUTHERN APPALACHIAN MOUNTAIN STREAMS AND TERRESTRIAL NITRIFIERS,
Forest Service (USDA), Franklin, N.C. Coweeta Hydrologic Lab.
For primary bibliographic entry see Field 5B.
W77-01423

STREAMFLOW NITROGEN LOSS FOLLOWING FOREST EROSION CONTROL FERTILIZATION,
Forest Service (USDA), Portland, Oreg. Pacific Northwest Forest and Range Experiment Station.
For primary bibliographic entry see Field 4D.
W77-01431

HYDROGEOLOGICAL AND GEOPHYSICAL INVESTIGATIONS OF A GEOTHERMAL ANOMALY IN HUNGARY; II. GEOTHERMAL FLOW SYSTEM IN THE TISZAKECSKE REGION,
Research Inst. for Water Resources Development, Budapest (Hungary).
For primary bibliographic entry see Field 4B.
W77-01436

AMELIORATION OF SUBSURFACE ACIDITY BY LEACHING OF SURFACE APPLIED AMENDMENTS. A LABORATORY STUDY,
Fruit and Fruit Technology, Research Inst., Stellenbosch (South Africa).
For primary bibliographic entry see Field 2G.
W77-01483

WONDERFUL WATER (WONDERLIKE WATER), (IN AFRIKAANS),
P. J. Aucamp.
Spectrum, Vol 13 (2), p 24-26, (1975).

Descriptors: Chemical properties, Physical properties, Demineralisation, Distillation, *Water properties, Water treatment.
Identifiers: South Africa.

Described are the physical and chemical properties of water that help to make it the remarkable compound, the mechanics that regulate the fact that ice floats instead of sinks, why water has a higher heat capacity than other compounds, and why water is such a good solvent. Various methods of purifying tap water are described. Among the processes described are distillation and demineralisation. (South Africa)
W77-01486

SPECIFIC ADSORPTION OF TRACE AMOUNTS OF CALCIUM AND STRONTIUM BY HYDROUS OXIDES OF IRON AND ALUMINUM,
Massey Univ., Palmerston North (New Zealand). Dept. of Soil Science.
For primary bibliographic entry see Field 2G.
W77-01513

PRECIPITATION OF CALCIUM AND STRONTIUM SULFATES AROUND PLANT ROOTS AND ITS EVALUATION,
Purdue Univ., Lafayette, Ind. Dept. of Agronomy.
For primary bibliographic entry see Field 2I.
W77-01514

2L. Estuaries

TEMPERATURE VARIATION IN FIDDLER CRAB MICROHABITATS,
Texas Univ. at Austin, Port Aransas. Marine Science Inst.
For primary bibliographic entry see Field 5C.
W77-01058

NITROGEN FIXATION IN THE RHODE RIVER ESTUARY OF CHESAPEAKE BAY,
Maryland Univ. Baltimore County, Baltimore. Dept. of Biological Sciences.
For primary bibliographic entry see Field 5C.
W77-01059

TEMPERATURE AND THE VERTICAL DISTRIBUTION OF TWO TIDEPOOL FISHES (OLIGOCOTTUS MACULOSUS, O. SNYDERI),
Southeastern Massachusetts Univ., North Dartmouth. Dept. of Biology.
For primary bibliographic entry see Field 5C.
W77-01060

DISTRIBUTION AND SIGNIFICANCE OF FECAL INDICATOR ORGANISMS IN THE UPPER CHESAPEAKE BAY,
Maryland Univ., College Park. Dept. of Microbiology.
For primary bibliographic entry see Field 5C.
W77-01061

SEASONAL SHIFTS IN THE SPAWNING SITE OF A NORTHEAST PACIFIC INTERTIDAL FISH,
British Columbia Univ., Vancouver, B. C. Inst. of Animal Resource Ecology.
J. B. Marliave.
Journal of the Fisheries Research Board of Canada, Vol. 32, No. 10, October 1975, p 1687-1691, 3 fig, 1 tab, 7 ref.

Descriptors: Environmental effects, *Fish, *Spawning, Temperature, Seasonal, Waves(Water), On-site investigations, *Pacific Ocean, Intertidal areas.
Identifiers: *Black prickleback, Xiphister atropurpureus.

Spawning sites of the black prickleback, Xiphister atropurpureus, were studied. Shifts in spawning sites during the winter and spring spawning periods were observed. This species selects underboulder substrates of shells, pebbles, and small rocks that provide spaces most nearly matching the cross-sectional body size of the adults for spawning sites. Spawning occurs under such a wide range of water temperatures from December to May that slight temperature variations between sites could not solely account for differences. The seasonal shift probably results because wave action decreases as temperatures increase during the spring. (Chilton-ORNL)
W77-01063

SEASONAL DISTRIBUTIONS OF LARVAL FLATFISHES (PLEURONECTIFORMES) ON THE CONTINENTAL SHELF BETWEEN CAPE COD, MASSACHUSETTS, AND CAPE LOOKOUT, NORTH CAROLINA, 1965-66,
National Marine Fisheries Service, Highlands, N. J. Sandy Hook Lab.; and National Marine Fisheries Service, Highlands, N. J. Middle Atlantic Coastal Fisheries Center.
W. G. Smith, J. D. Sibunka, and A. Wells.
NOAA Technical Report NMFS SSRF-691, June 1975, 68 p, 72 fig, 16 tab, 44 ref.

Descriptors: *Reproduction, *Spawning, *Seasonal, *Distribution patterns, Fish, Larvae, Eggs, Temperature, On-site investigations, Continental shelf, Atlantic Ocean.
Identifiers: Bothids, Pleuronectids, Cynoglossids, *Flatfish.

In a survey designed to locate spawning grounds and trace dispersion of fish eggs and larvae on the continental shelf, 4 families, 17 genera, and 15 species of fish were studied. The usual time of spawning was in the spring during seasonal temperature changes. Bothids have longer spawning seasons than pleuronectids, beginning in spring and continuing through early fall, in the southern half of the study area. Pleuronectids spawned in the spring in the northern half of the survey area. Cynoglossids spawned incidentally off North Carolina but most of their larvae were transported into the study area from spawning grounds south of Cape Lookout. There were only a few representatives of the family Soleidae and these originated south of Cape Lookout. Onset of spawning was triggered by spring warming and fall cooling with most species spawning within a relatively narrow range of temperatures. (Chilton-ORNL)
W77-01064

STATE REGULATION OF COASTAL WATER AREA PRESERVES,
Miami Univ., Fla., School of Law.
For primary bibliographic entry see Field 6E.
W77-01072

SOME WATER LAW PROBLEMS ASSOCIATED WITH ESTERO BAY, FLORIDA,
Florida Univ., Gainesville. School of Law.
For primary bibliographic entry see Field 6E.
W77-01091

TIDAL BOUNDARIES IN FLORIDA,
Florida Univ., Gainesville.
For primary bibliographic entry see Field 6E.
W77-01093

REDEVELOPMENTS ON THE OCEANFRONT,
Florida Univ., Gainesville. School of Law.
For primary bibliographic entry see Field 6E.
W77-01100

COASTAL CONSTRUCTION AND OTHER PHYSICAL ACTIVITIES SEAWARD OF THE MEAN HIGH WATER LINE,
Florida Univ., Gainesville. School of Law.
For primary bibliographic entry see Field 6E.
W77-01102

WAVE PREDICTION FOR THE EAST COAST OF INDIA UNDER STORM CONDITIONS IN THE BAY OF BENGAL,
Karnataka Regional Engineering Coll., Suratkal (India).
J. Dattatri, and P. Vijaya Kumar.
Indian Journal of Meteorology and Geophysics, Vol. 25, No. 2, p 211-222, April 1974. 9 fig, 1 tab, 15 ref.

Descriptors: *Waves(Water), *Forecasting, *Storms, *Winds, *Asia, Ocean waves, Monsoons, Coasts, Shores, Wavelengths, Graphical analysis, Wind tides, Bays, Oceans, Estuaries, Friction, Fluid friction, Fluid mechanics, Tropical cyclones, Oceanography, Meteorology.
Identifiers: *India, *Bay of Bengal(India), *Wave prediction.

Cyclonic storms are frequent in the Bay of Bengal, particularly during the NE monsoon period. Some of these storms are severe and generate high waves which cause havoc in the coastal regions. This paper presented an analysis of the cyclonic storm which hit coastal Andhra Pradesh on 7 November 1969. Wave prediction under storm conditions involves an analysis of moving fetches and variable wind speeds. Wilson's graphical method incorporating the latest available wave prediction relations was used for wave prediction. The predicted waves which are deep water waves were modified to account for refraction, shoaling, and bottom friction effects as they enter shallower waters. The predicted waves were compared with the waves observed by the Visakhapatnam outer harbor authorities. The results of the analysis suggested that (1) Wilson's graphical method can be applied for wave prediction for Indian coasts under storm conditions, (2) the recommended value of bottom friction factor appears to be low, and (3) waves of considerable height are experienced even in areas not in the direct path of the cyclone. (Sims-ISWS)
W77-01124

HYDROGEOLOGY OF THE QUATERNARY AND TERTIARY FORMATIONS ALONG THE SOUTH COAST OF THE ALGARVE PORTUGAL,
Vrije Universiteit, Amsterdam (Netherlands). Inst. of Earth Sciences.
For primary bibliographic entry see Field 2F.
W77-01136

NUMERICAL COMPUTATION OF WELL-MIXED ESTUARINE FLOWS,
Lanchester Polytechnic, Coventry (England). Dept. of Civil Engineering.
J. P. Grubert.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 102, No HY7, Proceedings Paper 12255, p 955-967, July 1976. 7 fig, 1 tab, 13 ref, 3 append.

Descriptors: *Coastal engineering, *Estuaries, *Saline water intrusion, *Diffusion, *Tides, Hydraulics, Algorithms, Methodology, Computers, Mathematics, Mathematical studies, Equations, *Mixing.
Identifiers: *Well-mixed estuaries, *India, *River Hoogly, Double-sweep algorithm.

Tidal estuaries are classified, depending on the amount of mixing of the salt and freshwater, into three groups: well mixed, partly mixed, and fully stratified. The flow ratio given by the tidal prism divided by the river discharge during a flood tide exceeds unity for a well-mixed estuary. A numerical model was presented for the computation of flow variables in such an estuary. The numerical method used was an implicit, unconditionally stable, finite difference scheme of second-order accuracy. Data were presented for the scheme in a physically realistic way to avoid nonlinear instabilities, and, for this purpose, the dynamic equations were written in pentadiagonal form and solved with a generalized double-sweep algorithm. The method was applied to the River Hoogly estuary in India. (Singh-ISWS)
W77-01139

MACROPHYTIC ALGAE OF THE VOSTOK BAY (SEA OF JAPAN), (IN RUSSIAN),
Akademiya Nauk SSSR, Vladivostok. Institut Morskogo Biologii.
For primary bibliographic entry see Field 5C.
W77-01142

UNSTEADY GROUNDWATER FLOW BENEATH STRIP OCEANIC ISLANDS,
Wisconsin Univ., Madison. Dept. of Geology and Geophysics.
For primary bibliographic entry see Field 2F.
W77-01143

AN ANALYSIS OF SALINITY VARIATIONS WITHIN GREAT SOUTH BAY, NEW YORK,
Environmental Defense Fund, East Setauket, N. Y.
P. D. Moskowitz.
Limnology and Oceanography, Vol. 21, No. 5, p 740-742, September 1976. 5 fig, 10 ref.

Descriptors: *Tidal waters, *Salinity, *Bays, *Lagoons, *New York, *Mixing, Streamflow, Outlets, Sewers, Low flow, Discharge(Water), Freshwater.
Identifiers: *Long Island, *Great South Bay(NY), *Salinity variations, *Tidal lagoons, Freshwater discharge-salinity relationships.

A series of correlation coefficients comparing streamflows with Great South Bay salinities indicated that changes in salinity observed within the bay were statistically associated with variations in streamflow. No significant correlation between salinity and rainfall was observed. The results may have significance to outfall sewering on Long Island. (Bender-ISWS)
W77-01149

SUBMARINE MEANDERING THALWEG AND TURBIDITY CURRENT FLOWING FOR 4,000 KM IN THE NORTHWEST ATLANTIC MID-OCEAN CHANNEL, LABRADOR SEA,
McGill Univ., Montreal (Quebec). Dept. of Geological Sciences.
S. Chough, and R. Hesse.

Geology, Vol. 4, No. 9, p 529-533, September 1976. 6 fig, 21 ref.

Descriptors: *Atlantic Ocean, *Turbidity, *Turbidity currents, *Thalweg, Sediment transport, Sedimentation, Meanders, Oceanography, Oceans, Channel morphology, Channels.
Identifiers: *Labrador Sea, *Deep sea channel, *Submarine meandering thalweg, Mid-ocean channel.

For the first time, the existence of a meandering thalweg and associated point bars was documented in detail for a mid-ocean channel. It was found that in the world's largest deep-sea channel, the Northwest Atlantic Mid-Ocean Channel of the Labrador Sea, average meander wave length of the thalweg is 50 km between lat 54 degrees and 57 degrees 30 minutes N. The ratio of the meander wave length to channel width was less than that for alluvial channels. Sediments recovered from the channel and natural levees were indicative of sedimentary mass transport in the channel by turbidity currents and related processes, some of which probably extended the entire length of the channel. (Lee-ISWS)
W77-01150

MODELING PHYTOPLANKTON BLOOMS IN A STRATIFIED EMBAYMENT,
Utah Water Research Lab., Logan.
For primary bibliographic entry see Field 5C.
W77-01163

RADIONUCLIDES IN CHESAPEAKE BAY SEDIMENTS,
National Aeronautics and Space Administration, Greenbelt, Md. Goddard Space Flight Center.
P. J. Cressey, Jr.
NASA Technical Note D-8196, 20 p, April 1976. 19 fig, 8 tab.

Descriptors: *Radioisotopes, *Radioactivity, *Bottom sediments, *Chesapeake Bay, *Radiochemical analysis, *Sediments, Bays, Fallout, Water quality, Radioactive wastes, Chemical analysis, Instrumentation, Nuclear powerplants, Cesium, Cobalt, Thallium radioisotopes, Estuaries, Analytical techniques, Nuclear physics, Nuclear powerplants.
Identifiers: *Radiochemical testing, Surface sediments, Natural radioactivity, Nuclear fallout, Trace minerals, Analytical methods, Bismuth 214, Ruthenium 106, Radiochemical sampling, Natural radionuclides, Manmade radionuclides.

Natural and manmade gamma-ray emitting radionuclides were measured in Chesapeake Bay sediments taken near the Calvert Cliffs Nuclear Power Plant site. Samples represented several water depths at six locations for five dates encompassing a complete seasonal cycle. Radionuclide contents of dry sediments ranged as follows: T1208, 40 to 400 pCi/kg; Bi214, 200 to 800 pCi/kg; K, 0.04 to 2.1%; Cs137, less than 5 to 1900 pCi/kg; Ru106, less than 40 to 1000 pCi/kg; Co60, less than 1 to 27 pCi/kg. In general, radionuclide contents were positively correlated with each other and negatively correlated with sediment grain size. (Henley-ISWS)
W77-01188

THE EFFECT OF PRESSURE ON THE IONIZATION OF BORIC ACID IN SODIUM CHLORIDE AND SEAWATER FROM MOLAL VOLUME DATA AT 0 AND 25 C,
Rosenstiel School of Marine and Atmospheric Sciences, Miami, Fla.
For primary bibliographic entry see Field 2K.
W77-01190

OCEANOGRAPHIC APPARATUS,
General Dynamics Corp., St. Louis, Mo. (Assignee).
E. L. Casco, and R. F. Kosic.
U. S. Patent No. 3,968,954, 15 p, 12 fig, 13 ref; Official Gazette of the United States Patent Office, Vol 948, No 2, p 566, July 13, 1976.

Descriptors: *Patents, *Instrumentation, *Oceans, *Sea water, Water properties, *Measurement, Temperature, Pressure, Conductivity, Oceanography.
Identifiers: Reeling systems, Reels, Sensors, Deployment and recovery.

The invention relates to oceanographic apparatus and particularly to a reeling system which is adapted to deploy and retrieve a sensor body which is attached to a line or cable so that measurements of ocean characteristics may be made through the use of the sensor. It is especially suitable for use in obtaining data from which a profile of ocean characteristics with respect to depth can be made. It is also suitable for use in other oceanographic apparatus in which cables or lines are deployed and retrieved. A cable, at the end of which is attached a sensor, is wound around a reel having a flange in which a spiral cam is formed. In order to deploy the sensor, the reel is adapted to tilt to a downward vertical position so as to permit free fall of the sensor and cable over the cam flange and through a fairlead which may be secured in and extending through the hull of an ocean data buoy. The reel is tilted to a horizontal position and rotated in order to retrieve the sensor, the cam flange guiding the cable onto the hub of the reel which may be rocked during winding so as to obtain a level wind on the reel hub. The fairlead protects the sensor once it is retrieved. During free fall, the weight distribution and shape of the sensor provides for stability and a constant drop rate. Data (such as temperature, pressure and conductivity) is transmitted to the surface via a conductor in the cable and using sea water as a return path. (Sinha-OEIS)
W77-01214

BREAKWATER CONSTRUCTION,
Raymond International, Inc., Houston, Tex. (Assignee).
For primary bibliographic entry see Field 8B.
W77-01221

FLOATING BREAKWATERS,
Ishikawajima-Harima Heavy Industries Co., Tokyo (Japan). (Assignee).
For primary bibliographic entry see Field 8B.
W77-01222

IN-SITU OCEANOGRAPHIC SAMPLE SEPARATOR,
Office of the Secretary (Navy), Washington, D.C.
S. J. Niskin.
U.S. Patent No. 3,969,925, 7 p, 3 fig, 3 ref; Official Gazette of the United States Patent Office, Vol 948, No 3, p 894, July 20, 1976.

Descriptors: *Patents, *Sampling, *Water sampling, *Testing, *On-site investigations, *On-site tests, Suspended solids, Separation techniques, Oceanography.
Identifiers: Particulate separator.

Water samples in most investigations must be brought to the surface where particulate matter is separated, treated, and then lowered agin for a period of incubation at the natural depth environment. This procedure subjects the particulate matter sample to changing environmental conditions as well as to possible contamination. Since separation of the samples from the captured water is usually conducted in a laboratory, an additional opportunity for contamination is introduced. This invention, a sampling device for in situ oceanographic investigations includes a sample chamber in which water samples are received and exited by a dual-valve arrangement. The valves are messenger-actuated in two discrete steps, the first step involving actuating the sampler, filling its chamber with water, injecting a tracer solution, and allowing the particulate sample matter to incubate. The second step, independently messenger-actuated, causes the release of compressed gas into the chamber via a manifold, forcing the contained water out through an appropriate filter after which the sampling device is recovered empty of all contents except whatever particulate matter has been collected by the filter which matter is immediately ready for laboratory analysis. (Sinha-OEIS)
W77-01223

BREAKWATER SYSTEM FOR CREATING ARTIFICIAL SANDBARS,
For primary bibliographic entry see Field 8B.
W77-01231

KEPONE: HAZARD TO AQUATIC ORGANISMS,
Environmental Protection Agency, Gulf Breeze, Fla. Gulf Breeze Lab.
For primary bibliographic entry see Field 5C.
W77-01235

THE EFFECTS OF THERMAL EFFLUENT ON THE AMERICAN OYSTER, CRASSOSTREA VIRGINICA GMELIN IN INDIAN RIVER BAY, DELAWARE,
Delaware Univ., Newark. Coll. of Marine Studies.
For primary bibliographic entry see Field 5C.
W77-01237

THE EFFECT OF TEMPERATURE ON THE BEHAVIOR OF YOUNG TAUTOG, TAUTOGA ONITIS (L.),
National Marine Fisheries Service, Highlands, N.J. Sandy Hook Lab.
For primary bibliographic entry see Field 5C.
W77-01241

SPATIAL DISPERSION OF AN ESTUARINE BENTHIC FAUNAL COMMUNITY,
Swedish Water and Air Pollution Research Lab., Goteborg.
For primary bibliographic entry see Field 5B.
W77-01246

PCB CONTENTS IN MARINE ANIMALS COLLECTED IN THE EAST CHINA SEA, (IN JAPANESE),
Hokkaido Univ., Sapporo (Japan). Lab. of Food Hygiene.
For primary bibliographic entry see Field 5C.
W77-01255

ACUTE TOXICITIES OF CRUDE OILS AND OIL-DISPERSANT MIXTURES TO RED SEA FISHES AND INVERTEBRATES,
Hebrew Univ., Jerusalem (Israel). Heinz Steinitz Marine Biology Lab.
For primary bibliographic entry see Field 5C.
W77-01256

LATENT EFFECTS OF IRANIAN CRUDE OIL AND A CHEMICAL OIL DISPERSANT ON RED SEA MOLLUSCS,
Hebrew Univ., Jerusalem (Israel). Heinz Steinitz Marine Biology Lab.
For primary bibliographic entry see Field 5C.
W77-01262

ARE HOVERCRAFT A MAJOR CAUSE OF DISTURBANCES TO INERTIDAL INVERTEBRATES,
Institute of Terrestrial Ecology, Norwich (England). Colney Research Station.
For primary bibliographic entry see Field 6G.
W77-01263

OPTIMUM ALLOCATION STRATEGIES FOR SAMPLING BENTHOS IN THE NEW YORK BIGHT,
Rhode Island Univ., Kingston. Marine Experiment Station.
For primary bibliographic entry see Field 5A.
W77-01264

THE ACCUMULATION OF PCB AS A FUNCTION OF GROWTH IN JAPANESE ANCHOVY CAUGHT IN OSAKA BAY, (IN JAPANESE),
Osaka Prefectural Fisheries Experimental Station, (Japan).
For primary bibliographic entry see Field 5C.
W77-01265

MERCURY IN EGGS OF NORWEGIAN SEABIRDS,
Tromsoe Univ. (Norway). Inst. Biology and Geology.
For primary bibliographic entry see Field 5A.
W77-01267

MEAN HIGH WATER MARK AND USE OF TIDELANDS IN FLORIDA,
Florida State Dept. of Health and Rehabilitative Services, Vero Beach. Medical Entomology Lab.
M. W. Provost.
Fla Sci. 36(1), p 50-66, 1973.

Descriptors: *Florida, *Tidal waters, *Water levels, *Tidal marshes, Marshes, *High water mark.
Identifiers: *Tidelands.

An analysis of ocean tide patterns is used to explain the difficulties in determining the mean high water mark in Florida (USA). Seasonal oscillations of the sea are so related to tide intervals that a submergence periodicity on the tidelands is created which is unique to the state. The high marsh remains dry during 1 part of the yr and is almost continuously tide-flooded during the other. Important differences between Atlantic and Gulf coasts are demonstrated. The high marsh, located between mean neap high and mean spring high tide levels, occupies more of the tidelands in Florida than the low marsh. For the protection of tidelands it is recommended that they be delineated by their vegetation until more tidal bench marks are available.--Copyright 1975, Biological Abstracts, Inc.
W77-01279

WAVES IN COASTAL WATERS OFF MANGALORE; PT. I: DISTRIBUTION OF WAVE CHARACTERISTICS,
Naval Physical and Oceanographic Lab., Cochin (India).
K. V. Sundara Raman, M. J. Varkey, P. K. Vijayarajan, V. C. John, and M. X. Joseph.
Indian Journal of Meteorology and Geophysics, Vol. 25, Nos. 3 and 4, July and October 1974. 7 fig, 2 tab, 13 ref.

Descriptors: *Waves(Water), *Pressure measuring instruments, *Ocean waves, *Measurement, On-site investigations, Data processing, Analytical techniques, Oceans, Bays, Coasts, Energy, Frequency, Oceanography.
Identifiers: *India, Wave heights, Wave periods, Energy spectra.

A pressure recorder for measuring sea waves had been installed off MangaLore. Wave record obtained from the recorder were analyzed, and wave parameters like period, height, etc., were obtained for the period June 1968 to May 1969. Frequency distribution of wave heights and wave periods during various months was drawn. Energy spectra obtained from data were presented. From the study of the distributions of wave parameters, it was found that period follows normal distribution, and the height follows Rayleigh distribution. The energy spectra were composite in nature, giving the average condition for a month when the record for the whole month was considered as a single record. (Sims-ISWS)
W77-01330

THEORETICAL MODEL FOR THE FORMATION OF ION-PAIRS IN SEAWATER,
Rhode Island Univ., Kingston. Graduate School of Oceanography.
For primary bibliographic entry see Field 2K.
W77-01341

CHEMICAL AND PHYSICAL CHARACTERISTICS OF WATER IN ESTUARIES OF TEXAS, OCTOBER 1971-SEPTEMBER 1973,
Geological Survey, Austin, Tex.
For primary bibliographic entry see Field 5B.
W77-01416

THE BENTHOS OF SOME SOUTHERN AFRICAN LAKES PART 3: THE BENTHIC FAUNA OF LAKE NHLANGE, KWAZULU, SOUTH AFRICA,
Rhodes Univ., Grahamstown (South Africa). Dept. of Zoology and Entomology; and Rhodes Univ., Grahamstown (South Africa). Inst. of Freshwater Studies.
For primary bibliographic entry see Field 2H.
W77-01437

TEMPERATURE RECORDING IN SHALLOW MARINE ENVIRONMENTS,
Cape Town Univ. (South Africa). Dept. of Zoology.
A. H. Fricke, and A. B. Thum.
Trans. Roy. Soc. S. Afr. Vol 41, Part 4, p 351-357, (1975). 3 fig, 13 ref.

Descriptors: *Shallow water, Equipment, *Temperature, Measuring instruments, *Reproduction, Animal behavior, Coasts.
Identifiers: South Africa, Parechinus angulosus, *Sea urchins.

The shallow inshore water masses around the Cape coast are mixed with regard to temperature and frequently experience marked fluctuations. We needed a device giving a continuous record of in situ temperature to investigate its effect on the reproductive behaviour of Parechinus angulosus Leske, a common local sea urchin. Commercial temperature recorders were enclosed in watertight housings designed for the purpose and installed on the sea-bed at the study sites. (South Africa)
W77-01446

METHANE, CARBON DIOXIDE, AND DISSOLVED SULFATE FROM INTERSTITIAL WATER OF COASTAL MARSH SEDIMENTS,
Louisiana State Univ., Baton Rouge. Coastal Studies Inst.
For primary bibliographic entry see Field 5B.
W77-01495

PHYTOPLANKTON DIVERSITY AHD CHLOROPHYLL-A IN A POLLUTED ESTUARY,
Montclair State Coll. Upper Montclair, N. J. Dept. of Biology.
For primary bibliographic entry see Field 5C.
W77-01499

SHELL DISEASE IN CRABS AND LOBSTERS FROM NEW YORK BIGHT,
National Marine Fisheries Service, Highlands, N. J. Sandy Hook Lab.
For primary bibliographic entry see Field 5C.
W77-01500

ARTIFICIAL ISLANDS: INFORMATION NEEDS AND IMPACT CRITERIA,
Delaware Univ., Lewes. Marine Studies Center.
For primary bibliographic entry see Field 6G.
W77-01501

INCIDENCE OF SHELL DISEASE IN SHRIMP IN THE NEW YORK BIGHT,
National Marine Fisheries Service, Highlands, N. J. Sandy Hook Lab.
For primary bibliographic entry see Field 5C.
W77-01502

CULTURE STUDIES ON THE EFFECTS FROM BORATE POLLUTION ON THE GROWTH OF MARINE PHYTOPLANKTERS,
Fisheries and Marine Service, Vancouver (British Columbia). Vancouver Lab.
For primary bibliographic entry see Field 5C.
W77-01506

ACUTE TOXICITY OF CHLORINE TO SELECTED ESTUARINE SPECIES,
Virginia Inst. of Marine Sciences, Gloucester Point.
For primary bibliographic entry see Field 5C.
W77-01508

THE EFFECT OF THE PRELIMINARY ADAPTATION TEMPERATURE ON THE DISTRIBUTION OF JUVENILE COD (GADUS MORHVA) AND POLLOCK (POLLACHIUS VIRENS) WITHIN A TEMPERATURE GRADIENT,
Murmanskii Morskoi Biologicheskii Institut (USSR).
For primary bibliographic entry see Field 5C.
W77-01509

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

WATER LAW AND NEW TECHNOLOGIES.
United Nations, New York.
For primary bibliographic entry see Field 6E.
W77-01184

PROCESS FOR EXTRACTING DISSOLVED SALTS FROM WATER,
Dames and Moore, San Francisco, Calif. (Assignee).
C. W. Garbe.
U.S. Patent No. 3,966,539, 4 p, 6 ref; Official Gazette of the United States Patent Office, Vol 947, No 5, p 2226, June 29, 1976.

Descriptors: *Patents, *Desalination, *Demineralization, *Separation techniques, *Evaporation, *Evaporation control, Water treatment, Saline water, Air-water interfaces, Settling basins, Thin films, Solar radiation.

A process is described for concentrating salt dissolved in a salt-saturated water by accelerated evaporation. It has been found that water evaporates rapidly from thin films in the range of 1 to 2 mils thickness which can be developed over a mixture of suspended solids in water. A particulate solid is selected having a density which exceeds that of the salt-saturated liquid and preferably exceeds the density of the salt-saturated liquid by a factor of about 2.0. The solid particulate matter is then mixed with the salt-containing solution to form a slurry. The atmosphere-exposed surface of the slurry is periodically agitated to produce a uniform mixture at the surface from which the suspended particles begin to settle, yielding the thin film of water. The film thickness increases as

the particle settlement progresses and achieves the optimum for evaporation. Agitation is effected periodically to prevent the formation of a dry surface skin over the slurry. When the concentration of the salt dissolved in the water within the slurry approaches the saturation level, agitation of the slurry ceases. Complete settlement of the solid particulate matter is then permitted. The liquid is then decanted from the top of the slurry close to its point of saturation, and is coventionally processed (by solar evaporation) to cause crystallization of the desired salt. (Sinha-OEIS)
W77-01198

MULTI-STAGE FLASH DISTILLATION PLANT,
Agency of Industrial Science and Technology, Tokyo (Japan). (Assignee).
T. Mukushi, K. Izumi, S. Takahashi, Y. Okazima, and T. Sawa.
U.S. Patent No. 3,966,562, 6 p, 3 fig, 6 ref; Official Gazette of the United States Patent Office, Vol 947, No 5, p 2232-2233, June 29, 1976.

Descriptors: *Patents, *Desalination, *Sea water, Saline water, Separation techniques, Distillation, Flash distillation, Water purification, Equipment.

A multi-stage distillation plant consists of a multi-flash evaporator provided with a multi-flash chamber which is divided into a heat recovery section and a heat rejection section. The flash evaporator is provided with a deaerator for deaerating cold sea water, a thickener for separating brine containing a relatively great amount of seeds, from concentrated brine which has been extracted from a front chamber of the final stage flash chamber, and a seed mixing tank for obtaining a seed-mixed brine. Part of the sea water which has passed through the deaerator is supplied as a feed sea water to the rear chamber of the final stage flash chamber. The brine containing relatively great amount of seed and extracted from the thickener is joined to the seed-mixed brine fed from the seed mixing tank. Thus, the confluent brine thus joined together is discharged for deaeration into the final stage flash chamber from a distributor provided in the rear chamber. (Sinha-OEIS)
W77-01199

METHOD FOR PREVENTING SCALE IN SALINE WATER DESALTING APPARATUS AND SALINE WATER RECLAMATION APPARATUS FOR CARRYING OUT SAID METHOD,
Ishikawajima-Harima Engineering Review, Tokyo (Japan). (Assignee).
J. Sakuma, and S. Takahashi.
U. S. Patent No. 3,969,193, 5 p, 1 fig, 4 ref; Official Gazette of the United States Patent Office, Vol 948, No 2, p 641, July 13, 1976.

Descriptors: *Patents, *Desalination, *Demineralization, *Saline water, *Waste water treatment, Scaling, *Descaling, Acids, Hydrogen ion concentration, Corrosion control.

A method for use in a flash distillation apparatus for saline water desalting is provided for removing the scale formed from saline water and accumulated upon the heating surfaces of the apparatus before the growth of the scale starts. During the time the desalting operation is being performed, an acid is added to the saline water for short periods at predetermined time intervals immediately before entering and/or in the course of the condensation and heating passages of the whole system of the condensation, heating and heat-recovery passage for saline water. The periodically introduced acid thereby repetitively dissolves and removes alkali scale formed upon the heating surfaces at the stage at which very fine nuclei of scale are formed. (Sinha-OEIS)
W77-01215

THE REMOVAL OF SALT AND ORGANIC MATERIAL FROM SEWAGE EFFLUENT BY ANION EXCHANGE RESINS,
Cape Town Univ. (South Africa). Dept. of Chemical Engineering.
For primary bibliographic entry see Field 5D.
W77-01364

WONDERFUL WATER (WONDERLIKE WATER), (IN AFRIKAANS),
For primary bibliographic entry see Field 2K.
W77-01486

3B. Water Yield Improvement

A TECHNIQUE FOR PREDICTING THE AQUATIC ECOSYSTEM RESPONSE TO WEATHER MODIFICATION,
Utah Center for Water Resources Research, Logan.
E. K. Israelsen, D. R. Bernard, T. M. Twedt, and H. M. Runke.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-260 492, Price codes: A08 in paper copy, A01 in microfiche. Utah Water Research Laboratory, Publication PRWG138-1, December 1975. 157 p, 21 fig, 21 tab, 148 ref, 3 append. OWRT B-105-UTAH(1). 14-31-0001-4135.

Descriptors: Aquatic habitats, Water temperature, Periphyton, Fish reproduction, *Weather modification, *Cloud seeding, *Utah, *Model studies, *Forecasting, *Ecosystems.
Identifiers: Spawn Creek(Utah), Logan(Utah), Logan Canyon(Utah).

In the past, considerable effort has been spent on the development of techniques for increasing precipitation from a given cloud formation. However, little attention has been given to identifying and evaluating the impacts of cloud seeding activities on the aquatic ecosystems within the affected areas. The objective of this study was to apply the simulation technique to predict the impacts of cloud seeding on the aquatic ecosystem within the area subject to weather modification. A small mountain watershed near Logan, Utah, was selected for the study. Measurements were made of the significant parameter levels under current conditions. A hydrologic and water temperature model was calibrated to the watershed to predict the change in water temperature and stream velocities from arbitrary increases in the snowpack. The predicted water velocities and temperatures were used to link the hydrologic system to the aquatic ecosystem which consisted of primary production, invertebrate, and fish communities. The study was conducted over a very short time base, and thus cannot be regarded as being absolutely conclusive, but the results do indicate trends which might be expected if various decreases of water temperature and increases in stream velocity were to occur.
W77-01051

RESULT OF OPERATIONAL CLOUD SEEDING EXPERIMENT OVER RIHAND CATCHMENT IN NORTHEAST INDIA,
Institute of Tropical Meteorology, Poona (India).
R. K. Kapoor, K. Krishna, U. S. De, K. G. S. Nair, and I. C. Talwar.
Indian Journal of Meteorology and Geophysics, Vol. 25, Nos. 3 and 4, p 379-384, July and October 1974. 1 fig, 6 tab, 8 ref.

Descriptors: *Cloud seeding, Weather modification, *Artificial precipitation, Aircraft, Cloud physics, Rainfall, Precipitation(Atmospheric), Weather, Statistics, Data processing, Watersheds(Basins), Reservoirs, Water resources, Meteorology.
Identifiers: *India, *Uttar Pradesh(India), *Rihand Reservoir(India).

A cloud seeding experiment, on operational basis, was performed during August-September, 1973 over the catchment area of the Rihand reservoir in the state of Uttar Pradesh, India. For unavoidable reasons, it was not possible to seed on 27 days scattered throughout the experimental period. The unseeded days were considered control days, and the unseeded areas adjoining the catchment were considered control areas. The results of the experiment were evaluated, and the analysis suggested a rainfall increase in the seeded catchment area of over 17%. However, the increase was not considered to be statistically significant. (Sims-ISWS)
W77-01129

WATER SALVAGE POTENTIALS IN UTAH, VOLUME II, EVAPORATION SUPPRESSION BY RESERVOIR DESTRATIFICATION,
Utah Water Research Lab., Logan.
For primary bibliographic entry see Field 2D.
W77-01164

DRAFT ENVIRONMENTAL STATEMENT: PROJECT SKYWATER A PROGRAM OF RESEARCH IN PRECIPITATION MANAGEMENT, VOLUME I OF II.
Bureau of Reclamation, Washington, D.C.
For primary bibliographic entry see Field 6G.
W77-01187

POTENTIAL FOR WATER YIELD IMPROVEMENT IN ARIZONA THROUGH RIPARIAN VEGETATION MANAGEMENT,
Arizona Univ., Tucson. School of Renewable Natural Resources.
R. S. Affleck.
Ph. D. Dissertation, 1975. 4 fig, 15 tab, 183 ref.

Descriptors: *Water yield improvement, *Water supply, *Riparian plants, *Vegetation, Hydrology, *Arizona, Riparian land, Desert plants, Arid lands, Biocontrol, Antitranspirants.

New knowledge gained over the past 15 to 20 years on management of riparian zones in Arizona for water yield improvement has been organized and analyzed. Hydrologic processes and principles applicable to riparian zones, the distribution and nature of riparian vegetation in Arizona, and new resource management methods, needs, and constraints have been evaluated. The relationship between vegetation management for water yield improvement and other resource-based products and uses of riparian zones such as timber, range for livestock, wildlife and fish, recreation, and asthetics has been assessed; the need for a survey of riparian vegetation is cited. Five water yield improvement methods applicable to riparian zones are evaluated: conversion of one vegetation type to another, channelization, cottonwood thinning, anti-transpirant and biological control treatments. (Jamail-Arizona)
W77-01282

SOIL MOISTURE USE BY VELVET MESQUITE (PROSOPIS JULIFLORA),
Arizona Univ., Tucson. School of Renewable Natural Resources.
For primary bibliographic entry see Field 2G.
W77-01283

IS MAN CHANGING THE WEATHER.
National Center for Atmospheric Research, Boulder, Colo.
H. Lansford.
Lantern, Vol XXIII (4), p 2-5, (1974).

Descriptors: *Weather modification, Cloud seeding, Air pollution, Nucleation, Carbon dioxide, Dust storms, United States.

There is increasing evidence that man is changing the weather. The author surveys some of the ex-

periments and theories that shed light on this important and possibly ominous development. He points out that cloud-seeding is not only done by weathermen in weather modification experiments but that pollutants from automobile exhausts and from high flying jet aircraft, as well as dust from industry and agriculture perform unintentional cloud-seeding sometimes triggering terrific storms and sometimes overseeding clouds to an extent where all moisture particles become frozen nuclei, leaving insufficient moisture to make them grow larger. The effect of carbon dioxide accumulation in the atmosphere, due to the burning of fossil fuels and the so-called 'Greenhouse Effect' is also discussed. (South Africa)
W77-01353

COMMENTS ON THE STORAGE OF WATER VAPOUR IN THE ATMOSPHERE OVER SOUTH AFRICA,
Natal Univ., Pietermaritzburg (South Africa).
For primary bibliographic entry see Field 2B.
W77-01365

A HYDRO-ECONOMIC EVALUATION OF FORESTRY IN THE EERSTE RIVER CATCHMENT,
Department of Forestry, Pretoria (South Africa).
For primary bibliographic entry see Field 4A.
W77-01368

ALLOCATION OF WATER TO FORESTRY AND OTHER USERS IN THE CATCHMENT OF THE EERSTE RIVER,
Jonkershoek Forest Research Station, Stellenbosch (South Africa).
For primary bibliographic entry see Field 4D.
W77-01385

ESTIMATING WATER YIELD DIFFERENCES BETWEEN HARDWOOD AND PINE FORESTS: AN APPLICATION OF NET PRECIPITATION DATA,
Forest Service (USDA), Grand Rapids, Minn. North Central Forest Experiment Station.
E. S. Verry.
Research Paper NC-128, 1976, 12 p, 3 fig, 8 tab, 20 ref.

Descriptors: *Forest watersheds, *Forest management, Streamflow, Deciduous trees, *Water yield, Coniferous trees, Pine trees, Interception, *Minnesota, *Precipitation(Atmospheric), *Snowfall.
Identifiers: *Aspen, *Red pine, *Black spruce, Forest conversions.

Net rainstorm and net seasonal snowfall equations derived from new studies and the literature are applied to aspen and red pine forests in north-central Minnesota to estimate net seasonal and annual precipitation. These equations provide the basis for making objective assessments of the impact of hardwood-pine conversions on water yield. An appendix also includes net precipitation data for a black spruce forest. (Forest Service)
W77-01425

MAXIMUM PEAK FLOW FOR SELECTED RETURN PERIODS FOR WATERSHEDS WEST OF THE CONTINENTAL DIVIDE IN IDAHO AND MONTANA,
Forest Service (USDA), Ogden Utah. Intermountain Forest and Range Experiment Station.
For primary bibliographic entry see Field 4D.
W77-01435

RESULTS OF THE MULTIPLE CATCHMENT EXPERIMENTS AT THE JONKERSHOEK RESEARCH STATION, SOUTH AFRICA. 2. INFLUENCE OF PROTECTION OF FYNBOS ON STREAM DISCHARGE IN LANGRIVIER,
Jonkershoek Forest Research Station, Stellenbosch (South Africa).
For primary bibliographic entry see Field 4D.
W77-01474

3C. Use Of Water Of Impaired Quality

WATER AND SALT DISTRIBUTION IN A SOIL UNDER TRICKLE IRRIGATION,
Arizona Univ., Tucson. Dept. of Soils, Water, and Engineering.
M. C. S. Leao.
Ph.D. Dissertation, 1975, 14 fig, 14 tab, 30 ref.

Descriptors: *Leaching, *Irrigation systems, *Soil-water-plant-relationships, *Irrigation effects, Permeability, Lettuce, Soil water, Salts, *Salinity, *Salt tolerance.
Identifiers: *Trickle irrigation.

A field study was conducted to determine water and salt distribution patterns in soil irrigated by pairs of double-chamber, perforated polyethylene tubes in two experiments: a water distribution and salt distribution experiment. Moisture profiles are presented for the various water distribution tests. Water movement in the soil was two to three times greater in the horizontal than in the vertical direction. Wetted soil volume showed a high positive correlation with both volume of water applied and with time of application. Salt accumulation occurred mainly at the soil surface between the irrigation tubes and away from the main root zone of the plants. The surface accumulation was followed by a leached zone. There were no significant differences in yield among plots receiving different treatments. The study indicated that trickle irrigation with water of high salt content is likely to cause a high surface concentration of salts. Application of extra amounts of water by the trickle system, or another method, is recommended to leach the soils to a depth below the crop root zone. (Jamail-Arizona)
W77-01271

SOIL-WATER-PLANT RELATIONSHIPS - IMPORTANT DESIGN CRITERIA FOR IRRIGATION-PLANNING, (GROND-PLANT-WATER-VERHOUDINGS AS BELANGRIKE ONTWERP-GEGEWENS VIR BESPROEIING-SBEPLANNING),
Stellenbosch Univ. (South Africa). Dept. of Agriculture.
H. W. Weber.
Tegnikon, No. 2, p 2-10, (1975). 2 fig, 2 tab.

Descriptors: Irrigation design, Irrigation systems, Brackish water, Crop production, Dissolved solids, Soils, *Soil-water-plant relationships, Design criteria.
Identifiers: South Africa, Soil clogging.

In arid climates the production potential of irrigated soils is perpetually being menaced by decline and eventual destruction. The causes are mainly (i) the use of low quality waters having a high content of total dissolved solids, for irrigation and (ii) over-irrigation. Both causes are closely interconnected and either can originate the other. The exploitable water resources of Southern Africa will progressively be absorbed by the growing economy and expanding municipal areas. Therefore, less and less water will in future be allocated to an irrigation agriculture hitherto accustomed to luxury consumption endangering the soil. The irrigation farmer will have to produce the same or even higher harvests with less water in order to comply with the requirements of a responsible and rational water use and, simultaneously, to check the further decline of the quality of his soils. A basic knowledge about the interactions between soils, plants and water within any given set of climatic conditions is an indispensable necessity. In a simple, non-technical language some of the more important factors involved and their interdependency as well as their use for the design of irrigation projects are given. (South Africa)
W77-01454

3D. Conservation In Domestic and Municipal Use

SUGARLOAF CREEK PROJECT (AUSTRALIA): FLOOD STUDIES.
Melbourne and Metropolitan Board of Works (Australia). Water Supply Div.
For primary bibliographic entry see Field 8A.
W77-01067

FUTURE DIRECTION OF URBAN WATER MODELS,
Water Resources Engineers, Inc. Walnut Creek, Calif.
For primary bibliographic entry see Field 5G.
W77-01071

A SUBURBAN MODEL OF RATIONAL GROUND WATER UTILIZATION: A PLAN FOR NASSAU COUNTY,
City Univ. of New York.
For primary bibliographic entry see Field 4B.
W77-01182

IDENTIFYING URBAN FLASH FLOODING PROBLEMS,
Washington Univ., St. Louis, Mo. Dept. of Technology and Human Affairs.
For primary bibliographic entry see Field 4A.
W77-01351

THE EFFECTS OF PRESSURE ON DOMESTIC WATER SUPPLY INCLUDING OBSERVATIONS ON THE EFFECT OF LIMITED GARDEN-WATERING RESTRICTIONS DURING A PERIOD OF HIGH DEMAND,
Johannesburg City Engineer's Dept. (South Africa).
D. S. Gebhardt.
Water SA., Vol 1(1), p 3-8, (1975). 6 fig, 2 tab, 1 ref.

Descriptors: *Domestic water, *Water demand, Water conservation, *Water utilization, Leakage, *Water pressure, *Water consumption, Water supply, Cities, Hydrostatic pressure.
Identifiers: South Africa, Johannesburg.

Water is precious in South Africa. Water engineers throughout the country are constantly considering ways of improving urban supply systems and of saving this rather scarce commodity. In Johannesburg one aspect of urban water conservation is receiving special attention, namely the effects of excessive pressure in reticulation systems on water wastage. The problem is to what extent such pressures contribute to the overall wastage of water and what steps could be taken to rectify the position. The author comes to the conclusion that changes in the pressure of supply have an immediate effect on consumption throughout the whole system. A rise of over 60% in pressure causes a 30% increase in consumption in a residential township. The results of leakage tests show that losses are proportional to pressure. (South Africa)
W77-01360

IMPROVED ANAEROBIC DIGESTION OF SOLID URBAN WASTE,
For primary bibliographic entry see Field 5D.
W77-01462

THE ENERGY POTENTIAL OF MUNICIPAL SOLID WASTES IN SOUTH AFRICA,
Stellenbosch Univ. (South Africa). Dept. of Chemical Engineering.
M. A. Connor.
The Civil Engineer in South Africa, Vol 17 (11), p 295-301, (1975). 7 tab, 26 ref.

Descriptors: *Solid wastes, Energy, Economics, Fuels, Pyrolisis, *Municipal wastes, Waste treatment, *Recycling.
Identifiers: South Africa, *Waste recovery.

Municipal solid wastes are currently receiving attention as potential minor sources of energy. Wastes can make a contribution of the overall energy situation in four ways: directly, by combustion of wastes to produce energy; indirectly, by conversion to gaseous, liquid or solid fuels; by returning to the economy materials manufactured by energy intensive processes; and by providing a feedstock for the manufacture of materials normally produced from key energy resources such as oil. The advantages, disadvantages and economics of different processes in each of the above categories are compared and related to the South African situation. It is concluded that, in the medium to long-term, municipal solid wastes can make a small but significant contribution to this country's energy supplies. (South Africa)
W77-01463

APPLICATION OF MUNICIPAL BY-LAWS WITH SPECIAL REFERENCE TO DRAINAGE REGULATIONS,
Johannesburg City Engineer's Dept. (South Africa).
For primary bibliographic entry see Field 4A.
W77-01485

EVALUATION REPORT: WATER RESOURCES APPRAISAL FOR HYDROELECTRIC LICENSING. DAYTON DEVELOPMENT, PROJECT NO. 287, FOX RIVER, WISCONSIN AND ILLINOIS.
Federal Power Commission, Washington, D.C. Bureau of Power.
For primary bibliographic entry see Field 6F.
W77-01511

3E. Conservation In Industry

AN EXPLORATORY STUDY OF POSSIBLE ENERGY SAVINGS AS A RESULT OF WATER CONSERVATION PRACTICES,
Oklahoma Univ., Norman. Bureau of Water and Environmental Resources Research.
G. W. Reid.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-260 490, Price codes: A07 in paper copy, A01 in microfiche. Completion Report, July 1976. 135 p, 12 fig, 28 tab, 25 ref. OWRT A-061-OKLA(1).

Descriptors: *Water conservation, *Energy, *Cost analysis, Water reuse, Waste disposal, Recycling, *Alternative water use, *Alternative costs, Municipal water.
Identifiers: *Household water conservation alternatives, Savings in water, Savings in energy.

The objective is to evaluate energy consumption from the use of various alternatives of water conservation practices. The amount of water saved from each alternative is first calculated. Then, from each of these potential water savings, the amount of energy involved and the economical effect of each alternative can be determined. This study includes comparisons of eighty-one possible household water conservation devices and reuse systems with conventional water use methods and comparisons of flow reduction from residential uses as results of the alternatives. Total monetary savings in energy of each alternative, associated with pumping, heating, transmission and operation for water production and wastewater treatment are compared with the total monetary savings in water of the water-saving devices. A cost-effectiveness analysis and the ratings of the conservation alternatives in terms of both energy and water saved are presented.
W77-01052

COAL AND THE ENVIRONMENT, ABSTRACT SERIES, MINE DRAINAGE BIBLIOGRAPHY, 1910-1976.
Bituminous Coal Research, Inc., Monroeville, Pa.
For primary bibliographic entry see Field 5G.
W77-01192

WASTE WATER TREATMENT,
Swift and Co., Chicago, Ill. (Assignee).
For primary bibliographic entry see Field 5D.
W77-01217

CHROMIUM REMOVAL AND RECOVERY PROCESS,
Cunningham (John), Portsmouth, Ohio (Assignee).
For primary bibliographic entry see Field 5D.
W77-01220

AVAILABILITY OF WATER FOR COAL CONVERSION,
Bureau of Reclamation, Billings, Mont. Upper Missouri Region.
P. Q. Gibbs.
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol. 102, No. WR2, p 219-225, November 1976. 2 fig, 2 tab.

Descriptors: *Water supply, *Coals, *Water pollution, Aqueducts, Energy, Water sources, River basins, Water allocation(Applied), Storage, Diversion, *Great Plains, Energy conversion.
Identifiers: *Water availability, Energy companies, *Coal conversion.

Coal is abundant in the Northern Great Plains. Other forms of energy from converting coal require water. Sources where substantial water supplies are available are limited, but there are some that could serve Montana, Wyoming, and North Dakota. Sources are primarily in Upper Missouri River Basin and tributaries. The Yellowstone River Compact allocates water between Montana and Wyoming on four interstate tributaries. Existing storage impoundments are preferred. Locations, capacities, and streamflow are shown. Possible routes and cost of water conveyance have been determined in studies by the Bureau of Reclamation. Energy companies hold options to some stored waters. Ground water from Madison Formation deep beneath the Fort Union-Powder Basin Coal Region is possible as an alternative water source. Federal and state cooperation is required to make developments possible, and developers are required to satisfy environmental statues. (Bell-Cornell)
W77-01345

WATER CONFLICTS IN WESTERN COAL DEVELOPMENT,
Montana State Univ., Bozeman. Dept. of Civil Engineering and Engineering Mechanics.
T. T. Williams.
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineering, Vol. 102, No. WR 2, p 327-339, November 1976. 4 fig, 6 tab, 10 ref.

Descriptors: *Coal mines, *Water resources, *Water allocation(Policy), *Land use, *Energy, Mining, Montana, North Dakota, Wyoming, Strip mines, Water utilization, Irrigation, Water rights.
Identifiers: *Water conflicts.

Coal development is increasing rapidly in the Northern Great Plains. Strip mining in the Montana, North Dakota, Wyoming Fort Union region may reach 977,000,000 tons per year by the year 2000. Water requirements for surface strip mining are negligible, but significant quantities are required for conversion processes. Using the fastest rate of production currently projected, a total of 800,400 acre-ft per year could be needed. This much water is available in the region, but the major conflicts which exist are: new storage reservoirs may be required to provide the water when needed; possible agricultural development may need all the water that can be made available; fish and wildlife needs, recreation uses, and environmental preservation may preclude development. (Bell-Cornell)
W77-01349

WATER AVAILABLE FOR ENERGY--UPPER COLORADO RIVER BASIN,
Utah State Engineer's Office, Salt Lake City.
D. C. Hansen.
Journal of the Water Resources Planning and Management Division, Vol. 102, No. WR2, Proceedings of the American Society of Civil Engineers, p 341-348, November 1976. 1 tab, 5 ref.

Descriptors: *Colorado River, *Water resources, *Water rights, *Energy, Water supply.
Identifiers: Regional planning.

The Upper Colorado River Basin has abundant deposits of fossil fuels and minerals, and numerous projects are in progress, planned or projected, to extract these resources. The first question that needs to be answered to make it possible for these projects to become reality is the availability of water. The Upper Colorado River Basin states are presently depleting 60% of the water apportioned to them under the Colorado River Compact of 1922. Of the 40% remaining it is difficult to specify the exact amount of water available for future development because of the uncertainty of the amount of water needed to satisfy the Indian water rights and the amount of water that has been committed to various projects by the Upper Colorado River Basin states. A joint effort between Federal, state, and Indian leaders is needed to make water available for energy development and to insure that all Indian water rights are satisfied. (Bell-Cornell)
W77-01350

POWER AND WATER FOR SOUTH WEST AFRICA,
South West Africa Water and Electricity Corp. (Pty) Ltd., Windhoek.
A. D. W. Wolmarans.
The Professional Engineer, Vol 4(4), p 5-11, (1975).

Descriptors: *Water supply, *Water demand, *Hydroelectric power, *Africa, Water resources development, Future planning(Projected), Electrical power industry, *Electrical power production.
Identifiers: *South West Africa, Southern Africa, Kunene River, Okavango River, Gove Dam, Caleuque Dam, Ruacana Falls, Ovambo.

A description is given of the background, origin, growth, present position and immediate future of the South West Africa Water and Electricity Corporation (Pty) Ltd. (SWAWEK) in its endeavour to stimulate the growth and development of the territory of South West Africa. The further development of the enormous potential of the Kunene River and in addition, the development of the potential of the Okavango River not only for the generatio of electrical power but also for the supply of water, will expand the infrastructure necessary for the future development of the territory of S.W.A. (South Africa)
W77-01382

ESCOM PIONEERS DRY COOLING,
T. J. Sheer.
Construction in Southern Africa, Vol. 20(2), p 35-39, (1975).

Descriptors: *Thermal powerplants, Water requirements, Water conservation, *Cooling towers, Design, Operations.
Identifiers: *South Africa, *Transvaal, *Dry cooling.

A description is presented of the design and operation of the South African Electricity Supply Commission's (ESCOM) dry-cooling tower system for a 200 megawatt turbo-generator set at Grootvlei Power Station in Transvaal. This type of cooling system, which is still in the prototype stage in several countries, has a promising future in both fossil-fuelled and nuclear power stations. The Escom dry-cooling tower is presently the largest operating dry tower in the world, dissipating heat to the atmosphere at a rate of 330 megawatts. A description is presented the influence of various atmospheric conditions on the performance of the tower, mention is made that no significant corrosion of the heat exchanger has occurred and that operating staff have not encountered any control or maintenance difficulties. (South Africa)
W77-01467

THE COOLING WATER EQUATION,
For primary bibliographic entry see Field 6D.
W77-01468

QUENCHING SALDANHA'S THIRST.
Saldanha-Sishen Progress Report, Suppl. Construction in S.A. and Coal, Gold and Base Minerals of Southern Africa, January 1975, p 53-63.

Descriptors: *Water requirements, *Water supply development, Costs, Future planning(Projected), Iron and steel industry, Water utilization, *Industrial water, Bays, *Water demand, Potable water, *Estimated costs.
Identifiers: *Saldanha Bay, *South Africa, Berg River, Voelvlei Dam.

It is pointed out that the massive development underway at Saldanha Bay has made it imperative that water supply to the area be improved. To this end the South African Department of Water Affairs is embarking on an amitious water project which will aim at supplying the area with over 100 000 m3/day of fully potable water by 1977/78. It is estimated that the cost of the scheme will be in the region of R42-million. Estimated water requirements for domestic purposes, the operation of iron ore and harbour facilities, steel production and general industries are tabulated up to the year 2000. (South Africa)
W77-01473

CONTROL OF WATER POLLUTION - A HIDDEN RESOURCE, (BEHEER OOR WATERBESOEDELING - 'N VERBORGE HULPBRON),
Department of Water Affairs, Pretoria (South Africa).
For primary bibliographic entry see Field 5G.
W77-01489

3F. Conservation In Agriculture

THE IMPACT OF INCREASED ENERGY COSTS ON WATER USE AND AGRICULTURAL OUTPUT IN NORTHWESTERN OKLAHOMA,
Oklahoma State Univ., Stillwater. Dept. of Agricultural Economics.
H. P. Mapp, Jr, and V. R. Eidman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-260 487, Price codes: A05 in paper copy, A01 in microfiche. Completion Report, September 1976. 95 p, 9 fig, 27 tab, 28 ref. OWRT A-057-Okla(2), 14-34-0001-6037.

Descriptors: Irrigation, Energy, Surface-groundwater relationships, *Economics, *Farm management, *Irrigation systems, *Irrigation efficiency, Drawdown, Aquifers, *Deep-well pumping, Overdraft, Water table, *Cultivation, Zone of saturation, Fuels, Economic impact, Costs, Farm prices.
Identifiers: Reduced tillage, Natural gas, *Energy conservation, Fossil fuels.

This study was designed to (1) identify production practices which reduce tillage operations, resulting in reduced fossil fuel energy use and increased net returns, (2) determine optimum organizations of production for representative farms maximizing net returns and maximizing net kilocalories of output, and (3) evaluate the impact of rising natural gas prices on optimum organizations of production for farms in alternative resource situations under low and high crop prices. Reduced tillage methods increase both net returns and net kilocalories of output. Organizations of production obtained when maximizing net kilocalories of output require more fossil fuel inputs per farm, result in a shift to crops that utilize the forage as well as the grain produced and lead to negative net returns. Rising natural gas prices have several potential effects. First, they increase the cost of pumping and, other things equal, reduce the level of net returns associated with irrigated crop production. Second, shifts from high to moderate levels of irrigation occur under constant and increasing natural gas prices due to changes in the water table and pumping costs over time. Third, rising natural gas prices result in a more rapid return to dryland farming and a two-thirds reduction in net returns.
W77-01056

MODEL WATER RESOURCES PROGRAM,
For primary bibliographic entry see Field 6E.
W77-01079

DRIP IRRIGATION: ISRAEL TEACHES CALIFORNIA,
A. Marquis.
The Nation, Vol 220, p 403-4, April 5, 1975. 2 p.

Descriptors: *Water distribution(Applied), *Foreign countries, *Water yield improvement, *Irrigation design, *Irrigation efficiency, Irrigation systems, Irrigation engineering, Crop response, Drainage effects, Farm management, Irrigated land, Water control, Distribution systems, Sprinkler irrigation, Furrow irrigation, California.
Identifiers: *Drip irrigation, Israel.

Drip irrigation, with its many benefits and few liabilities, seems to be the agricultural wave of the future. The basic idea, evolved over the past 15 years, is to dribble water at the rate of about a gallon per hour directly to the plant roots, rather than spray as much as 60 gallons per hour into the air or channel streams into furrows where perhaps half is lost to evaporation. Among the benefits are: (1) brackish water can be used in a drip system; (2) secondary effluent from a sewage treatment plant can be used; (3) plums and oranges will flourish on half the water; (4) land that was either too rocky or too steep can now be brought under cultivation; (5) costs drop dramatically; and (6) fertilizer can be added to the water. The major problem is the clogging of dispersal heads, but this is being worked out with the help of better filters. Prospects for use in developed countries are excellent; however, where labor is cheaper than the cost of introduction of this system ($600 per acre), the switch to drip irrigation is a long way off. (Frank-Florida)
W77-01080

NON-SIDE-SPLASH WATER SPRINKLERS,
M. Drori.
U.S. Patent No. 3,966,122, 7 p, 7 fig, 4 ref; Official Gazette of the United States Patent Office, Vol 947, No 5, p 2093, June 29, 1976.

Descriptors: *Patents, *Irrigation, *Sprinkler irrigation, *Irrigation practices, *Irrigation efficienty, Distribution systems, Water distribution(Applied), Application equipment.

The object of the invention is to provide a new arrangement for preventing or reducing side-splash in water sprinklers. The non-side-splash feature can be applied to various standard sprinkler head constructions, requiring merely a simple and inexpensive modification to adapt them for the non-side-splash function. The sprinkler includes a splash guard carried by the sprinkler head at a location to be impinged by the water splashed laterally from the drive member to substantially block side-splash. Also the rotational axis of the sprinkler head is substantially aligned with the general vicinity of impingement of the water splashed against the splash-guard such that little or no rotary torque is applied to the sprinkler head. (Sinha-OEIS)
W77-01197

RATING OF IRRIGATED SOILS OF THE SAL'YAN REGION, (IN RUSSIAN),
For primary bibliographic entry see Field 2G.
W77-01208

DRIP IRRIGATION DEVICE,
R. L. Hendrickson.
U. S. Patent No. 3,968,930, 4 p, 4 fig, 5 ref; Official Gazette of the United States Patent Office, Vol 948, No 2, p 557, July 13, 1976.

Descriptors: *Patents, *Irrigation, *Irrigation practices, *Irrigation efficiency, *Flow control, *Flow restriction water, Distribution(Applied), Application equipment, Water control.
Identifiers: *Drip irrigation.

A flow restrictor fitting for use in drip irrigation can be connected between two lengths of hose and when used in series with a number of lengths of hose provides means for irrigating areas by emitting small drips at each of the fittings to minimize waste of water. The central core member has a portion adjacent one end that is enlarged in outer diameter. This enlarged portion has a helical rib or thread defined on the outer surface and adjacent one end has an opening from the central passageway to the outer surface having the helical rib. A shell or cover member is threadably mounted onto the central core member and has a generally cylindrical inner surface that surrounds the helical rib and provides an enclosed helical flow restriction channel or passage. An opening is provided from the through passage of the core member to the helical rib so that water can flow in the recesses between the ribs along the length of the helix so that only a small, controlled drip of water will be emitted. The device is manufactured from plastic materials. (Sinha-OEIS)
W77-01213

PIPE-FOLLOWING IRRIGATION MACHINE,
Wright Rain Ltd., Ringwood (England). (Assignee).
V. B. W. Harvey.
U.S. Patent No. 3,970,102, 15 p, 9 fig, 3 ref; Official Gazette of the United States Patent Office, Vol 948, No 3, p 953, July 20, 1976.

Descriptors: *Patents, *Irrigation, *Sprinkler irrigation, *Irrigation practices, *Irrigation efficiency, Water distribution(Applied), Conveyance structures, Water conveyance, Automatic control.

An irrigation machine has traction wheels which run along the top of a pipe having self-closing hydrants spaced apart in the length of the pipe. The machine is guided to follow the course of the

pipe. When the machine reaches a hydrant, the machine stops and a vertically-movable riser pipe in the form of a probe and connected to a water gun or other water distribution device automtically descends to open the hydrant valve and thus admit water to the riser pipe and to the water gun. The machine is fitted with a device which shifts the machine longitudinally of the hydrant as the riser pipe is lowered towards the hydrant so that when the probe end of the riser pipe enters the hydrant, the probe end will be in precise vertical alignment with the hydrant. After a predetermined time the riser pipe is raised, the hydrant valve closes and the machine travels along the pipe to the next hydrant. (Sinha-OEIS)
W77-01224

PIPE INSERTABLE EMITTER FOR IRRIGATION SYSTEMS,
Harmony Emitter Co., Inc., Tucson. Ariz. (Assignee).
R. C. Harmony.
U.S. Patent No. 3,970,251, 5 p, 4 fig, 7 ref; Official Gazette of the United States Patent Office, Vol 948, No 3, p 1005, July 20, 1976.

Descriptors: *Patents, *Irrigation, *Irrigation practices, *Irrigation efficiency, *Flow control, Water distribution(Applied), Application equipment, Erosion.
Identifiers: Emitters.

An emitter is provided which delivers a constant flow of water despite variations in the water pressure. A number of emitters are inserted along a water distribution line, each of which are self regulating to provide a constant water discharge rate regardless of the location along the line. The emitters can be replaced and require no adjustment to control the rate of water flow. They are usable with irrigation water having suspended particulate matter. The emitter is formed of the following elements: a base for conveying water from within the water distribution line and having a depending hollow shroud for penetrating the wall of the water distribution line; an apertured diaphragm mounted on the base for establishing a water discharge outlet; bias means for maintaining a constant rate of water and comprising a pair of opposed surfaces separable from one another for defining a single passageway for the water flow; and a cap for securing the diaphragm to the base. (Sinha-OEIS)
W77-01225

SOIL NITRATE LOSS DURING IRRIGATION: ENHANCEMENT BY PLANT ROOTS,
California Univ., Berkeley, Coll. of Natural Resources.
M. G. Volz, M. S. Ardakani, R. K. Schulz, L. H. Stolzy, and A. D. McLaren.
Agronomy Journal, Vol. 68, No. 4, p 621-627, July-August 1976. 6 fig, 1 tab, 31 ref.

Descriptors: *Nitrates, *Denitrification, *Irrigation effects, *Root systems, *Soil-water-plant relationships, Nitrogen, Nitrites, Absorption, Organic matter, Soil analysis, Soil microorganisms, Bacteria.

The effects of a root system on nitrate loss from soil solution during irrigation of two Hanford sandy loam plots, one fallow and the other planted with barley (Hordeum vulgare), are reported. Plots were ponded for 44 hours with a solution containing 100 ppm N and 46 ppm C1- (tracer for NO-3) as KNO3 and CaC12, respectively. Nitrate-nitrogen concentrations during irrigation were lower in most soil solution samples from 0 to 60 cm under barley than in those from fallow plosts, but C1-concentration profiles were the same to a depth of 45 cm. During the later irrigation period, nitrate losses due to microbial use of NO-3 under barley were almost 90% of the total. This is probably due to stimulation of dissimilatory nitrate and nitrate reduction by both organic C exuded from barley and a decreased soil redox potential. (Jahns-Arizona)
W77-01268

SETTLEMENTS IN THE RAJASTHAN CANAL IRRIGATION AREA, INDIA,
For primary bibliographic entry see Field 4C.
W77-01272

ENERGY SOURCES FOR IRRIGATION PUMPS IN NORTHWESTERN NEW SOUTH WALES,
University of New England, Armidale (Australia). Dept. of Geography.
J. J. J. Pigram.
Australian Geographical Studies, Vol. 13, No. 1, p. 85-93, April, 1975. 3 fig, 4 ref.

Descriptors: *Irrigation efficiency, *Irrigation operation and maintenance, *Pumping, *Natural gas, Fuels, Maintenance costs, Electric power costs, *Australia, Irrigation systems, Arid lands.
Identifiers: Diesel power, *New South Wales.

Since only nominal charges are levied for irrigation water in northwestern New South Wales, the major expense incurred in irrigation is the cost of pumping. The use of diesel fuels, electric power or natural gas is evaluated. Diesel has been preferred because it was more readily available. Although the cost of fuel for a diesel engine may be considerably less than the cost of electricity for a motor developing the same horsepower, a true comparison of operating costs should take into account lubrication requirements, maintenance, and interest and depreciation, among other factors. While electricity is gaining on diesel power for use in irrigation pumping, a new source of power, natural gas, has been discovered in commercial quantities in Australia and should prove to be an ideal source for irrigation pumping. (Jamail-Arizona)
W77-01274

LEAF WATER POTENTIAL AND STOMATAL ACTIVITY IN SORGHUM AS INFLUENCED BY SOIL MOISTURE STRESS,
Nebraska Univ., Lincoln. Dept. of Horticulture and Forestry.
For primary bibliographic entry see Field 2I.
W77-01276

A NOTE ON THE USE OF BENTONITE CLAY AS A SUB-SOIL MOISTURE BARRIER FOR VEGETABLE PRODUCTION ON DRYLANDS OF RAJASTHAN,
Central Arid Zone Research Inst., Jodhpur (India).
R. P. Singh, H. P. Singh, and K. C. Singh.
Annals of Arid Zone, Vol 14, No 1, p 63-66, 1975. 2 tab.

Descriptors: *Crop response, *Bentonite, *Vegetable crops, Percolation, *Clays, Crops, Sands, Moisture content, Water utilization, Soil profiles, Soil moisture, Soil types, Soil water, Return(Monetary).
Identifiers: *Rajasthan, *India.

Experiments were conducted on several vegetable crops to test the efficacy of bentonite clay in reducing deep percolation losses and increasing vegetable yields on the drylands of Rajasthan. Vegetable growers generally dig pits to prepare localized seed beds for planting Cucurbits. Pits of 30-35 centimeters in diameter were dug on sandy loam soil, and bentonite and FYM incorporated at different depths. Pits having the bentonite barrier exhibited higher moisture content at harvest and greater yield than the controls in the case of all vegetable crops tried. In the case of kakri, the yield differences show an interesting trend in that the vegetable yield increases with the depth of incorporation of the amendments. Use of bentonite results in substantial cost savings. (Jamail-Arizona)
W77-01277

RESPONSE OF WHEAT UNDER SUB-HUMID IRRIGATED CONDITIONS TO ATMOSPHERIC MISTING DURING GRAIN FILLING,
International Maize and Wheat Improvement Centre, Londres (Mexico).
D. R. Laing, and R. A. Fischer.
Agricultural Meteorology, Vol. 15, p 285-293, 1975. 4 fig, 2 tab, 9 ref.

Descriptors: *Mist irrigation, *Wheat, *Crop response, *Sub-humid climates, *Plant growth, Irrigation, Cereal crops, Grains(Crops), Crop production, Xylem, Water storage, Leaves, Stomata, Moisture stress, Soil water, Growth rates, Moisture content, Thermal stress.

Atmospherically-induced plant water deficit and/or high temperature effects have been postulated as possible limitations to grain yield in irrigated sub-humid environments. An experiment was conducted in northwest Mexico to test this hypothesis, using a high yielding dwarf variety of wheat grown under intensive irrigation. Misting during grain filling was automatically activated at ear temperatures above 25 degrees centigrade. Leaf relative water content and xylem water potential for the control and misted areas were measured. Stomatal resistance measurements indicated no difference between the two treatments throughout a diurnal cycle. Grain growth rate was slower in the misted treatment, apparently as a result of lower ear temperature. Treatments had no effect on final grain size and yield. Atmospherically-induced stress did not appear to limit grain yield under the meteorological conditions experienced during this experiment. (Jamail-Arizona)
W77-01284

SULFURIC ACID FOR THE TREATMENT OF AMMONIATED IRRIGATION WATER: II. REDUCING CALCIUM PRECIPITATION AND SODIUM HAZARD,
New Mexico State Univ., Las Cruces. Dept. of Agronomy.
For primary bibliographic entry see Field 5G.
W77-01286

R10 MILLION WATER SCHEME NEARS COMPLETION, IRRIGATING THE ISLANDS OF THE ORANGE.
Construction in Southern Africa, Vol 19 (10), p 60-65, (1975).

Descriptors: *Irrigation design, Islands, Economics, *Irrigation canals, Crop production.
Identifiers: *South Africa, *Orange River(So Africa).

The South African Department of Water Affairs seeked approval for an additional R1,3-million to complete the Uppington Islands Water Scheme. When the scheme was proposed in 1966 the total cost was put at R9,2-million. Since then the costs have risen considerably and the Department of Water Affairs needs the money to complete major portions of the scheme. Basically, the project provides for the betterment and extension of a group of irrigation schemes along the Orange River in the vicinity of Uppington. (South Africa)
W77-01375

OPTIMUM UTILISATION OF WATER,
Department of Agricultural Technical Services, Stellenbosch (South Africa). Winter Rainfall Region.
A. F. Kriel.
The Deciduous Fruit Grower, Vol. 25 (1), p 20-27, (1975).

Descriptors: *Irrigation design, *Irrigation efficiency, Water conservation, Water consumption, Soil-water-plant relationships, Soil moisture content, Soil hydraulic characteristics, *Irrigation water, Optimization.
Identifiers: *South Africa, Western Cape.

In the intensive agricultural regions of the Republic of South Africa, the rainfall is seldom high enough to ensure optimum production without supplementing the natural rainfall. Soil, water and plants are inseparable in the production process. Irrigation water is valuable and as such it should be applied and used optimally in order to make optimum use of the soil. To date the emphasis has been on water conservation, but in future it will be necessary to give more attention to optimum utilisation of the available water. There is a wide range of factors affecting the use of water and these should be taken into consideration in planning irrigation practices. These factors include the physical nature of the soil, the quality and price of the water, the prevailing climate, the crop concerned with its needs and the distribution system. (South Africa)
W77-01383

FERTI-IRRIGATION - APPLICATION OF FERTILISER MATERIALS BY MEANS OF MICRO-IRRIGATION SYSTEMS - PART 1,
Stellenbosch Univ. (South Africa). Dept. of Soil Science.
P. F. Greeff.
The Deciduous Fruit Grower, Vol 25 (8), p 213-217, (1975). 3 fig, 2 tab, 3 ref.

Descriptors: *Fertilizers, *Irrigation, Soil water movement, Agriculture, Crop production, Nutrients, *Irrigation systems, Fertilization.
Identifiers: South Africa, *Ferti-irrigation, *Micro-irrigation systems.

Ferti-irrigation, simultaneous irrigation and fertilisation in local orchards and vineyards, has been made possible by the installation of permanent micro-irrigation systems and the availability of high-grade, completely water-soluble fertiliser materials. Ferti-irrigation, as a standard orchard practice, is becoming more popular. Most producers allow for incorporation of a permanent or portable fertiliser tank at the control centre of each irrigation block. Ferti-irrigation offers the producer the following advantages over conventional fertilisation practices: Localised placement of plant nutrients, movement of applied nutrients into the root zone, labour saving, and continuous supply of the required plant nutrients during the growth season. However, this technique can only be utilised economically and effectively when managed correctly. This report aims to illustrate the advantage gained from, and pitfalls experienced with, local ferti-irrigation. (See also W77-01394) (South Africa)
W77-01393

FERTI-IRRIGATION-APPLICATION OF FERTILISER MATERIALS BY MEANS OF MICRO-IRRIGATION SYSTEMS - PART 2,
Stellenbosch Univ. (South Africa). Dept. of Soil Science.
P. F. Greeff.
The Deciduous Fruit Grower, Vol 25 (9), p 240-245, (1975). 5 fig, 4 tab, 7 ref.

Descriptors: *Fertilizers, *Irrigation, Soil water movement, Operation and maintenance, Agriculture, Crop production, Nutrients, Fertilization, *Irrigation systems.
Identifiers: South Africa, *Ferti-irrigation, Micro-irrigation systems.

Ferti-irrigation, simultaneous irrigation and fertilisation, is common practice in orchards and vineyards irrigated by means of micro-irrigation systems. In Part 1 of this paper the requirements for successful ferti-irrigation with regard to application of the fertiliser material, soluble fertiliser materials and ferti-irrigation timing were discussed. In this Part the quality of fertiliser to be applied, movement of the applied nutrients in the soil and effective system maintenance will be discussed. (See also W77-01393) (South Africa)
W77-01394

LEAF ANALYSIS PROVES USEFUL IN INCREASING EFFICIENCY OF NITROGEN FERTILIZATION OF ORANGES AND REDUCING NITRATE POLLUTION POTENTIAL,
California Univ., Riverside. Dept. of Plant Sciences.
For primary bibliographic entry see Field 5G.
W77-01434

DISCHARGE CHARACTERISTICS OF SPACED SLITS IN POLYETHELENE PIPES UNDER PULSATING PRESSURE CONDITIONS,
Pretoria Univ. (South Africa). Dept. of Agricultural Engineering.
D. S. van der Merwe, and B. J. Grobler.
Water S A., Vol 1 (3), p 102-108, (1975). 10 fig, 1 tab, 2 ref.

Descriptors: *Plastic pipes, *Drip irrigation, Pressure conduits, *Discharge measurement, Pressure head, Temperature, Water temperature.
Identifiers: South Africa.

Slits in a polyethelene pipe, under pulsating pressure conditions, were investigated as a possible dripper for drip irrigation. A prerequisite for the practical implementation of slits is that cutting of the slits should be as simple as possible. An apparatus for cutting the slits was designed and tested. It appeared that the discharge from a slit under pulsating pressure conditions is mainly influenced by the pressure head during the discharge period, the duration of the discharge period, and the pulsation rate. There were indications that the temperature of the water has an important effect on the discharge, the extent of which will have to be determined. The effect of slit orientation on the discharge characteristics was also investigated. Three orientations were used, and it was clear that slits parallel to the longitudinal axis of the pipe was the only orientation suitable for practical use. (South Africa)
W77-01443

SYSTEM ANALYSIS: SPRINKLER SPACING, (SISTEEMANALISE: SPRINKELAAR-SPASIERING),
South Africa Dept. of Agricultural Technical Services, Pretoria.
J. N. de Bruyn.
Agriculture-Engineering in South Africa, Vol 9 (1), p 45-57, (1975). 2 fig, 1 tab.

Descriptors: Systems analysis, Computer models, Irrigation design, Spray irrigation, Sprinklers, Agricultural engineering, Model studies.
Identifiers: South Africa.

System analysis is not a new idea, but computer facilities have made it more applicable in agriculture. The main aim is to define system analysis in agricultural engineering. A practical example is given of a sprinkler spacing model. The model, except for saving labour during the official sprinkler distribution tests, can also be used for the design of sprinkler irrigation systems and the design of fire extinguishing systems in buildings using water sprinklers. (South Africa)
W77-01453

PRECIPITATION OF CALCIUM AND STRONTIUM SULFATES AROUND PLANT ROOTS AND ITS EVALUATION,
Purdue Univ., Lafayette, Ind. Dept. of Agronomy.
For primary bibliographic entry see Field 2I.
W77-01514

AMMONIA VOLATILIZATION FROM SURFACE APPLICATIONS OF AMMONIUM COMPOUNDS ON CALCAREOUS SOILS: IV. EFFECT OF CALCIUM CARBONATE CONTENT,
Texas A and M Univ., El Paso. Agricultureal Research Station.
For primary bibliographic entry see Field 2G.
W77-01515

CONVENTIONAL AND CONTROLLED-RELEASE NITROGEN SOURCES FOR RICE,
Arkansas Agricultural Experiment Station, Stuttgart. Rice Branch Experiment Station.
B. R. Wells, and P. A. Shockley.
Soil Science Society of America Proceedings, Vol. 39, No. 3, p 549-551, May-June 1975. 3 tab, 8 ref.

Descriptors: *Soils, *Fertilizers, *Fertilization, *Ureas, *Nitrogen, *Rice, Crop production, Crop response, Water pollution sources, Absorption, Path of pollutants.

Tests were conducted for the years 1967-1972 with rice to compare various formulations of sulfur-coated urea (SCU) and iso-butylidene diurea, (I.B.D.U.) with urea and ammonium sulfate as nitrogen sources on both silt loam and clay soils. The N sources were applied either preplant or top-dress at rates up to 235 kg/ha to drill-seeded rice which was flooded at approximately 2 weeks following seedling emergence. Grain yields, dry weight, and N uptake indicated that the controlled-release N sources could be used to regulate rate of N supply to the plant throughout the growing season. Growth of direct seeded rice was slowed considerably during the early part of the growing season due to the slow rate of N release but grain yields were not drastically altered. Grain yields on the silt loam soils following use of the controlled-release N fertilizers were consistently equal to those following use of urea or ammonium sulfate. On the clay soils under intermittent flooding, use of SCU resulted in increased yields as compared to urea applied preplant, and in one year resulted in increased yields as compared to urea applied in split topdress doses. Both SCU and I.B.D.U. were suitable N sources for rice growing under the water management systems employed in these studies. (Skogerboe-Colo St)
W77-01516

SULFURIC ACID FOR THE TREATMENT OF AMMONIATED IRRIGATION WATER: I. REDUCING AMMONIA VOLATILIZATION,
Arizona Univ., Tucson. Dept. of Soils, Water and Engineering.
For primary bibliographic entry see Field 5G.
W77-01517

PROSPECTS OF HYDROMETRY IN THE LIGHT OF MODERN TECHNOLOGY,
International Commission on Irrigation and Drainage, New Delhi (India).
For primary bibliographic entry see Field 7B.
W77-01519

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

RESEARCH TO DEVELOP ECOLOGICAL STANDARDS FOR WATER RESOURCES,
Oklahoma Univ., Norman. Bureau of Water and Environmental Resources Research.
For primary bibliographic entry see Field 6G.
W77-01054

A COARSE SORT SYSTEM FOR PRELIMINARY WATER RESOURCES MANAGEMENT ALTERNATIVES,
Oklahoma Univ., Norman. Bureau of Water and Environmental Resources Research.
For primary bibliographic entry see Field 6A.
W77-01055

SUGARLOAF CREEK PROJECT (AUSTRALIA): FLOOD STUDIES.
Melbourne and Metropolitan Board of Works (Australia). Water Supply Div.
For primary bibliographic entry see Field 8A.
W77-01067

A REVISED REGIONAL FREQUENCY CURVE FOR THE YARRA CATCHMENT ABOVE WARRANDYTE (AUSTRALIA).
Melbourne and Metropolitan Board of Works (Australia), Water supply, Sewerage and Drainage Branch.
Report No. MMBW-W-0052, October 1975. 9 p., 10 fig., 6 tables, 5 ref. Kesari, N., and Panagiotopoulos, P. (comp.).

Descriptors: *Design flood, *Flood recurrence interval, *Frequency curves, *Australia, Flood flow, Control structures, Design data, *Flood forecasting.
Identifiers: *Yarra River(Vic).

In cases where there are no streamflow data available at or in the vicinity of a proposed water control structure, the magnitude of a flood of predetermined recurrence interval derived from a regional frequency curve may be used for design purposes. For the Yarra catchment (Victoria, Australia) such a regional curve was derived in 1969; a revised curve is presented using additional data to 1973, and with some alterations in method. The methods and data used in the revision are described in detail. (CSIRO)
W77-01068

THE MERRI CREEK FLOOD, 15-16 MAY 1974; CITIES OF NORTHCOTE BRUNSWICK (AUSTRALIA),
Melbourne and Metropolitan Board of Works (Australia). Main Drainage Div.
For primary bibliographic entry see Field 2E.
W77-01069

WATER SUPPLY CATCHMENT HYDROLOGY RESEARCH: THE WALLABY CREEK FOG DRIP STUDY,
Melbourne and Metropolitan Board of Works (Australia). Hydrological studies Section.
For primary bibliographic entry see Field 2I.
W77-01070

OWNERSHIP ON NAVIGABLE WATERBOTTOMS--CALIFORNIA COMPANY V PRICE REVISITED,
For primary bibliographic entry see Field 6E.
W77-01078

MODEL WATER RESOURCES PROGRAM,
For primary bibliographic entry see Field 6E.
W77-01079

CAUGHT IN MID-STREAM: ARMY CORPS OF ENGINEERS,
For primary bibliographic entry see Field 6E.
W77-01086

SHORELAND REGULATION IN WISCONSIN,
Wisconsin Dept. of Natural Resources, Madison.
For primary bibliographic entry see Field 6E.
W77-01087

PUBLIC RIGHTS TO ARTIFICIAL WATERBODIES IN FLORIDA,
Florida Univ., Gainesville. School of Law.
For primary bibliographic entry see Field 6E.
W77-01088

UNITED STATES STEEL CORPORATION V SAVE SAND KEY, INC.: A LOSING BATTLE IN THE FIGHT FOR FLORIDA BEACHES,
Florida Univ., Gainesville. School of Law.
For primary bibliographic entry see Field 6E.
W77-01089

THE DEVELOPMENT AND IMPLEMENTATION OF THE COASTAL CONSTRUCTION SETBACK LINE LAW,
Florida Univ., Gainesville. School of Law.
For primary bibliographic entry see Field 6E.
W77-01090

DRAWING THE LINE AT THE OCEANFRONT, THE ROLE OF COASTAL CONSTRUCTION SET-BACK LINES IN REGULATING DEVELOPMENT OF FLORIDA'S COASTAL ZONE,
Florida Univ., Gainesville. School of Law.
For primary bibliographic entry see Field 6E.
W77-01097

COMPRESSION OF TIME-SERIES DATA,
Ministry of Works, Wellington (New Zealand). Water and Soil Div.
For primary bibliographic entry see Field 7C.
W77-01132

A CLIMATONOMIC STUDY OF THE LAKE ONTARIO DRAINAGE BASIN,
California Univ., Berkeley, Dept. of Geography.
For primary bibliographic entry see Field 2H.
W77-01146

THE MEASUREMENT OF WATER LOSSES FROM A FORESTED AREA USING A 'NATURAL' LYSIMETER,
Institute of Hydrology, Wallingford (England).
For primary bibliographic entry see Field 2D.
W77-01148

COMPARISON OF CHUTE AND STILLING BASIN PERFORMANCE FOR THREE DIFFERENT DROP BOX INLETS,
Agricultural Research Service, Stillwater, Okla. Water Conservation Structures Lab.
For primary bibliographic entry see Field 8B.
W77-01151

HISTORY AND DEVELOPMENT OF MULTIPLE OBJECTIVE PLANNING FOR WATER RESOURCES,
Water Resources Council, Washington, D.C.
For primary bibliographic entry see Field 6B.
W77-01152

THE ATTITUDE AND INTEREST OF THE ENVIRONMENTAL PROTECTION AGENCY IN MULTIPLE OBJECTIVE PLANNING OF WATER AND RELATED LAND RESOURCES,
Environmental Protection Agency, Washington, D.C. Office of Water Planning and Standards.
For primary bibliographic entry see Field 5G.
W77-01153

EMERGING CORPS OF ENGINEERS GUIDELINES FOR IMPLEMENTING THE PLANNING REQUIREMENTS OF WRC'S PRINCIPLES AND STANDARDS AND RELATED POLICIES,
Corps of Engineers, Washington, D.C. Planning Div.
For primary bibliographic entry see Field 6B.
W77-01154

IMPLEMENTATION OF MULTIPLE OBJECTIVE PLANNING BY THE SOIL CONSERVATION SERVICE,
Soil Conservation Service, Washington, D.C. River Basin.
For primary bibliographic entry see Field 6B.
W77-01155

PHILOSOPHY OF MULTIPLE OBJECTIVE PLANNING IN THE BUREAU OF RECLAMATION,
Bureau of Reclamation, Washington, D.C.
For primary bibliographic entry see Field 6B.
W77-01156

THE TENNESSEE VALLEY AUTHORITY AND MULTIPLE OBJECTIVE PLANNING,
Tennessee Valley Authority, Norris. Div. of Water Control Planning.
For primary bibliographic entry see Field 6B.
W77-01157

THE USE OF MULTIPLE OBJECTIVE PLANNING IN THE BUREAU OF LAND MANAGEMENT,
Bureau of Land Management, Denver, Colo.
For primary bibliographic entry see Field 6B.
W77-01161

DEVELOPING OPTIMAL OPERATING RULES FOR FLOOD PROTECTION RESERVOIRS,
Karlsruhe Univ. (West Germany). Institut fuer Wasserbau III.
G. A. Schultz, and E. J. Plate.
Journal of Hydrology, Vol. 28, No. 2/4, February 1976, p 245-264, 10 fig, 2 tab, 5 ref.

Descriptors: *Flood control, *Reservoir releases, *River systems, *Dynamic programming, *Analog computers, Optimization, Decision making, Algorithms, Equations, Systems analysis, Mathematical models.
Identifiers: *Operating rules, *Danube River(W. Germany).

During recent decades, a considerable increase of flood damage costs has been observed in various Central European countries, due mainly to the faster growth than the average population density of the larger cities and industrials districts along the main streams. The only means of reducing flood damage is by constructing flood protection reservoirs in the upper reaches of the rivers. It is vital to utilize the limited retention space most efficiently, to be accomplished through controlled reservoir releases to minimize overall catchment flood damage. This optimization problem is considered herein using a real world example on the Danube River. Examined are two different approaches to the problem: (1) development of near optimum reservoir release strategies which will lead to acceptable results without having forecasts, utilizing an electrical analog computer; and (2) development of optimum release strategies applicable for each single storm event using the dynamic programming method on a digital computer. For the special system and flood under consideration, parallel reservoirs are shown to best suit its purpose. (Bell-Cornell)
W77-01174

PUMPING POLICIES IN WATER SUPPLY,
Water Research Association, Marlow (England).
R. P. Donachie, K. Howard, P. A. Mawer, and T. Wyatt.
Journal of Hydrology, Vol. 28, No. 2/4, p 359-375, February 1976. (Published in Amsterdam) 5 fig, 1 tab, 4 ref.

Descriptors: *Water supply, *Pumping, *Operating costs, *Optimization, *Scheduling, Stochastics processes, Dynamic programming, Resource allocation, Water distribution(Applied),

Reservoirs, Constraints, Regression analysis, Linear programming, Systems analysis, Mathematical models.
Identifiers: *Cost minimization, Gradient search method, Mixed-integer programming, Control rules, Electricity tariffs, United Kingdom.

A large part of total operating expenses in water supply is attributable to pumping, thus providing a strong incentive for the optimization of pumping schedules. The need for optimal pumping schedules arises in systems of widely different characteristics. This paper considers three commonly occurring system types: resource systems under stochastic inputs; resource allocation to multiple demand areas; and distribution systems. Each of these system types calls for different solution methods. The paper emphasizes the importance of adequately modeling all significant features of the real system whilst at the same time retaining acceptable computing costs. For the first system type, dynamic programming and the gradient search method are both found to derive least-cost control rules under which the system will behave according to preset long term objectives. The second system can be optimized utilizing mixed-integer programming. Finally, the third system problem is solved by using regression analysis and a hill-climbing technique to reduce the maximum demand for electricity at each pumping station. (Bell-Cornell)
W77-01177

A COMPUTER-BASED TELECONTROL AND COMMUNICATION SYSTEM FOR A WATER SUPPLY NETWORK,
East Worcestershire Waterworks Co., Bromsgrove (England).
R. H. Burch, and K. C. Marlow.
Journal of Hydrology, Vol. 28, No. 2/4, p 407-427, February 1976. 3 fig.

Descriptors: *Water supply, *Networks, *Automatic control, *Computers, Pumping, *Communication, Telemetry.
Identifiers: England, *Telecontrol, Radio survey, Transmission equipment, Outstations.

The East Worcestershire Waterworks Company supplies water to a population of 200,000 over an area of 300 square miles in the county of Worcestershire, England. The 96-year old company has been working on a scheme of modernization of source works for the past 13 years. Existing diesel stations have been converted to electrical operation and automatic control equipment installed at all pumping stations. This article reports on the Company's resulting development of a centralized monitoring and control system for its expanding dimensions. Considered are: the planning stage; source works equipment, including automatic pumping control schemes; conversions; telemetry specification; communication links; radio survey; transmission equipment; speech communication; the telecontrol system; outstations; standby power; master station and control center; diesel alternator load-shedding; consumption trends; installation and commissioning; and subsequent operation. Although there is a greater degree of risk when using a centralized control scheme as opposed to the traditional method, the significant risks can be minimized. The scheme is economically viable. (Bell-Cornell)
W77-01179

FLORIDA'S SYSTEM FOR REGULATION OF WATER USE--A MODERN INSTRUMENT FOR SOUND WATER RESOURCE MANAGEMENT,
Florida Univ., Gainesville. Coll. of Law.
For primary bibliographic entry see Field 6E.
W77-01186

PROGRESS IN THE EXPLORATION AND IN THE SCIENTIFIC RESEARCH OF THE LIBYAN DESERT SINCE GERHARD ROHLFS,
Stuttgart Univ. (West Germany).
W. Meckelein.
Annals of the Geological Survey of Egypt, Vol. 5, p 47-60, 1975. 1 fig, 88 ref.

Descriptors: *Deserts, *Africa, *Exploration, *Land reclamation, *History, *Water resources development, Topography, Arid climates, Geologic investigations, Groundwater, Cultivation, Land use.
Identifiers: *Libyan Desert, Gerhard Rohlfs, Oases.

A history is presented of exploration of the Libyan Desert, especially since the Gerhard Rohlfs expeditions of 1873-74, and the scientific data collected by such exploration. The progress of cartography, history of climate, geomorphology and groundwater research pertaining to this region are discussed. Land reclamation has been carried out in the northern and northeastern border zones of the desert, such as the Siwa oasis and near the western Nile delta. Cultivation has been successful, and the desert landscape has been changed by new settlements and roads. However, the output and pressure of wells has declined, and pumping is increasingly necessary. Other problems are increasing salinity, often in the best soils, and moving sands which threaten fields and road traffic. Also discussed are possible projects for agrarian land use and/or industrialization given economic and environmental limitations. (Jahns-Arizona)
W77-01269

ENERGY FOR WATER,
Southern California Metropolitan Water District, Los Angeles.
For primary bibliographic entry see Field 6D.
W77-01273

RANGELAND DEVELOPMENT AND MANAGEMENT IN WEST RAJASTHAN,
Central Arid Zone Research Inst., Jodhpur (India).
L. D. Ahuja, and H. S. Mann.
Annals of Arid Zone, Vol. 14, p. 29-44, 1975. 2 tab, 33 ref.

Descriptors: *Range management, *Water conservation, *Soil conservation, *Pasture management, *Forages, Range grasses, Stock water, Deserts, Livestock, REvegetation, Drought, Arid lands, Brush control, Stabilization, Grazing, Animal control.
Identifiers: *Rajasthan, *India.

Range and pasture development in the arid zone of Rajasthan, while potentially very good, involves development and conservation of soil and water resources, and selection of the more productive, palatable and drought resistant plants to provide the required food. Various techniques for management and improved utilization of rangelands and pastures are presented and evaluated. A major problem in the interior areas of the desert is lack of drinking water for livestock. Drinking water requirements for range animals are presented. For good livestock production and improvement of the economy of the arid regions, rational use of the pasture is essential. (Jamail-Arizona)
W77-01281

POTENTIAL FOR WATER YIELD IMPROVEMENT IN ARIZONA THROUGH RIPARIAN VEGETATION MANAGEMENT,
Arizona Univ., Tucson. School of Renewable Natural Resources.
For primary bibliographic entry see Field 3B.
W77-01282

THE EFFECT OF ENVIRONMENTAL FACTORS ON THE GROWTH OF A NATURAL PASTURE,
Hebrew Univ., Jerusalem (Israel). Dept. of Botany.
For primary bibliographic entry see Field 2I.
W77-01285

MECHANICAL CONTROL OF EURASIAN WATERMILFOIL IN MARYLAND WITH AND WITHOUT 2,4-D APPLICATION,
Maryland Univ., Solomons. Chesapeake Biological Lab.
C. K. Rawls.
Chesapeake Science, Vol. 16, No. 4, p. 266-281, 1975. 2 fig., 4 tab., 27 ref.

Descriptors: *Integrated control measures, *Aquatic weed control, *Chesapeake Bay, Mechanical control, *Maryland, *2,4-D, Herbicides, Salinity, Growth rates.
Identifiers: *Eurasian watermilfoil, 2,4-D butoxyethanol ester, 2,4-D iso-octyl ester.

Eurasian watermilfoil (Myriophyllum spicatum) is a major nuisance in the upper part of Chesapeake Bay. Between 1961-1964 studies were made in Herring and Dundee Creeks to determine effective control methods. Normally milfoil reached the surface by early May and began to sink in high salinity waters about September 15 and in lower salinities about October 15. Mowing usually had to be repeated at least monthly during the growing season from mid-May to mid-September. Mowing was only effective for the season in which it was made. New nodal growth from cut milfoil stems or fragments made mowing impractical for large areas. If cutting was followed by herbicide application when new growth offered sufficient vegetative containment of applied 2,4-D impregnated attaclay granules, the vulnerable period of milfoil to 2,4-D was extended beyond anthesis. The 2,4-D butoxyethanol ester was more effective than the iso-octyl ester. No adverse effects to endemic fauna and flora were observed. Submersed waterfowl food plants, retarded by the milfoil overstory, grew rapidly when milfoil was thinned or removed. (Buchanan-Davidson--Wisconsin)
W77-01289

COMPARISON OF TWO MATHEMATICAL MODELS OF SURFACE RUNOFF,
New Mexico Inst. of Mining and Technology, Socorro.
For primary bibliographic entry see Field 2E.
W77-01334

DEALING WITH VARIABLE FLOOD HAZARD,
Corps of Engineers, Fort Worth, Tex.
For primary bibliographic entry see Field 6F.
W77-01343

WATER AVAILABLE FOR ENERGY--UPPER COLORADO RIVER BASIN,
Utah State Engineer's Office, Salt Lake City.
For primary bibliographic entry see Field 3E.
W77-01350

IDENTIFYING URBAN FLASH FLOODING PROBLEMS,
Washington Univ., St. Louis, Mo. Dept. of Technology and Human Affairs.
W. P. Darby, and M. J. Small.
Journal of the Water Resources Planning and Management Division, Vol. 102, No. WR2, Proceedings of the American Society of Civil Engineers, p 349-363, November, 1976. 2 fig, 7 tab, 1 equ, 13 ref.

Descriptors: *Flash floods, *Flood control, *Land use, *Statistical methods, *Streams, *Watersheds(Basins), Floods, Forecasting, Runoff, Mathematical models, Planning, Systems analysis, Methodology.
Identifiers: *Urban development, Water plans, Multiple discriminant analysis.

The focus of flood control activities in urban areas has been the alleviation of problems associated with major river flooding. Meanwhile, unplanned urban development has caused flooding problems of small streams to worsen, and eventually to

receive priority attention. Because of limited resources, flood control agencies must choose individual streams for immediate attention, while deferring flood control action on others. Very little direct information exists upon which to base an evaluation of the relative flash flooding problems of individual streams. A methodology, based on multiple discriminant analysis, is presented to provide a decision-making tool to establish flash-flood control priorities among a number of urban streams. The analysis is based on indirect measures of flash flooding problems (land-use characteristics of the watershed, stream configuration, etc.) that are readily available to the flood control agency, instead of flood damages inventories and hydrologic data, which are often unobtainable. Using the discriminant models, individual streams can be singled out for priority action. (Bell-Cornell)
W77-01351

A LABORATORY EVALUATION OF A DYE FOR THE CONTROL OF ALAGAL GROWTH,
National Inst. for Water Research, Pretoria (South Africa).
For primary bibliographic entry see Field 5G.
W77-01355

A TWO-DIMENSIONAL FLOOD ROUTING MODEL,
University of the Witwatersrand, Johannesburg (South Africa). Dept. of Civil Engineering.
H. W. Weiss, and D. C. Midgley.
The Civil Engineer in South Africa, Vol. 16 (12), p 359-365, p 113-114, (1974).

Descriptors: *Mathematical models, *Flood routing, *Flood plains, Retention, River systems, Channel flow, Model studies, Management, Water storage.
Identifiers: South Africa, Flood retention basins, Cross flow patterns, Crosslinking.

A cell-type mathematical model has been developed for routing of floods through complex river systems in which due account must be taken of storage attenuation effects, cross channel flow and flow reversals between channel and side-valley storage. Finite difference solutions of the simplified energy and continuity equations have been tested for stability and the model is ready for field calibration. It is intended as an aid to improved flood plain management. (South Africa)
W77-01358

A HYDRO-ECONOMIC EVALUATION OF FORESTRY IN THE EERSTE RIVER CATCHMENT,
Department of Forestry, Pretoria (South Africa).
D. W. Van Der Zel, and P. C. De Villiers.
Forestry in South Africa, No. 16, p. 19-26, (1975). 2 fig, 6 tab, 13 ref.

Descriptors: Forest watersheds, Forest management, River basins, Watersheds(Basins), River flow, Economics, Mathematical models, Water yield, Africa, Watershed management.
Identifiers: *South Africa, *Eerste River.

The present and possible future place of forestry in the Eerste River Catchment is illustrated and evaluated by a number of economic and hydro-economic formulae. It is shown that an area of 5000 ha of unused mountain land is available for forestry. An area of 3500 ha could be afforested and could add an annual R300 000 to the gross regional product (G R P). A mathematical model is developed from the evaluations to show that water use of the present situation on a forestry farm in the upper catchment of the Eerste River does not differ from that of the optimum mixed farming recommendation. Forestry in catchment areas in the Western and Southern Cape is justified and can be practised without detrimentally influencing other land owners in, or the water yield from such catchments. (South Africa)
W77-01368

THOR ACROSS THE LIMPOPO.
For primary bibliographic entry see Field 8A.
W77-01369

AFFORESTATION, CATCHMENT PROTECTION AND WATER SUPPLY DEMANDS,
Australian National Univ., Canberra. Dept. of Forestry.
For primary bibliographic entry see Field 4D.
W77-01371

ORANGE RIVER PROJECT, RIVER DIVERSION AT P K LE ROUX DAM,
For primary bibliographic entry see Field 8A.
W77-01372

EXPLORING THE DRAKENSBERG.
Construction in Southern Africa, Vol 20 (5), p. 93, 95, (1975).

Descriptors: Geologic investigations, Interbasin transfers, Water demand, Shafts, Tunneling, Hydroelectric plants, Pumped storage, Contracts, Hydraulic aspects, Rivers.
Identifiers: Tugela River, Vaal River, *South Africa.

A description is presented of the Tugela-Vaal Scheme in which water from the Tugela River is pumped over the Drakensberg escarpment to the Vaal River, which serves the major South African urban and industrial expansion areas, and has virtually reached its limit. The Scheme not only supplies water to the Vaal River but, making use of the pumped storage principle, generates 1000 MW of peaking power for the national electricity network. A description is given of the geological survey that preceded the excavation of the large underground cavern situated 195 m below ground level, which will be the machine hall, as well as details regarding the shafts and tunneling that coincided with the operation. (South Africa)
W77-01373

SOUTH AFRICA'S OWN SNOWY MOUNTAIN SCHEME,
For primary bibliographic entry see Field 8C.
W77-01374

R10 MILLION WATER SCHEME NEARS COMPLETION, IRRIGATING THE ISLANDS OF THE ORANGE.
For primary bibliographic entry see Field 3F.
W77-01375

HARNESSING THE CUNENE'S MIGHT.
For primary bibliographic entry see Field 8C.
W77-01376

SURFACE WATER SUPPLY OF THE UNITED STATES, 1966-70: PART 3. OHIO RIVER BASIN--VOLUME 1. OHIO RIVER BASIN ABOVE KANAWHA RIVER.
Geological Survey, Reston, Va.
For primary bibliographic entry see Field 7C.
W77-01412

SURFACE WATER SUPPLY OF THE UNITED STATES, 1966-70: PART II. PACIFIC SLOPE BASINS IN CALIFORNIA--VOLUME 4. NORTHERN CENTRAL VALLEY BASINS.
Geological Survey, Reston, Va.
For primary bibliographic entry see Field 7C.
W77-01413

STATISTICAL ANALYSIS OF WATER-LEVEL SPRINGFLOW, AND STREAMFLOW DATA FOR THE EDWARDS AQUIFER IN SOUTH-CENTRAL TEXAS,
Geological Survey, Austin, Tex.
For primary bibliographic entry see Field 4B.
W77-01417

MUNICIPAL WATERSHED MANAGEMENT SURVEY,
Forest Service (USDA), Franklin, N.C. Coweeta Hydrologic Lab.
For primary bibliographic entry see Field 4D.
W77-01422

SIMULATION OF EVAPOTRANSPIRATION AND DRAINAGE FROM MATURE AND CLEAR-CUT DECIDUOUS FORESTS AND YOUNG PINE PLANTATION,
Forest Service (USDA), Franklin, N.C. Coweeta Hydrologic Lab.
For primary bibliographic entry see Field 2D.
W77-01424

ESTIMATING WATER YIELD DIFFERENCES BETWEEN HARDWOOD AND PINE FORESTS: AN APPLICATION OF NET PRECIPITATION DATA,
Forest Service (USDA), Grand Rapids, Minn. North Central Forest Experiment Station.
For primary bibliographic entry see Field 3B.
W77-01425

A CHART FOR RESERVOIR YIELD ESTIMATION BASED ON THE MARKOV PROCESS,
T. B. Mitchell.
The Civil Engineer in South Africa, Vol 16 (9), p 289-293, (1974). 3 fig, 6 tab, 4 ref.

Descriptors: *Reservoir yield, *Storage coefficient, Evaporation, *Markov processes.
Identifiers: South Africa.

A simple example of the Markov process for a reservoir is outlined and a chart for the estimation of the yield of a reservoir with a gamma inflow distribution is presented in terms of storage ratio, coefficient of variation of annual inflow, reservoir evaporation characteristis and probability risk level. (South Africa)
W77-01445

FLOOD PROBLEMS IN UTTAR PRADESH,
Irrigation Commission, Lucknow (India).
For primary bibliographic entry see Field 2E.
W77-01450

DESIGN FLOOD SYNTHESIS BY EXCESS RAIN ROUTING,
University of the Witwatersrand, Johannesburg (South Africa). Hydrological Research Unit.
For primary bibliographic entry see Field 2A.
W77-01452

ENRICHMENT WILL MAKE US POORER, (VERRYKKING GAAN ONS ARMER MAAK),
National Inst. for Water Research, Pretoria, (South Africa).
For primary bibliographic entry see Field 5G.
W77-01456

THE KARAKAYA DAM AND HYDRO-ELECTRIC PROJECT IN EASTERN TURKEY,
For primary bibliographic entry see Field 8C.
W77-01465

CHANGE IN BIG DAM PLAN.
For primary bibliographic entry see Field 8D.
W77-01476

FACELIFT TO BEAT THE FLOODS.
For primary bibliographic entry see Field 8A.
W77-01477

R26M DAM PLAN FOR THE LOWVELD.
For primary bibliographic entry see Field 8A.
W77-01478

TIMBER AND WATER,
For primary bibliographic entry see Field 4C.
W77-01480

APPLICATION OF MUNICIPAL BY-LAWS WITH SPECIAL REFERENCE TO DRAINAGE REGULATIONS,
Johannesburg City Engineer's Dept. (South Africa).
W. H. C. Kroger.
Municipal Engineer, Vol 6(3), p 43-47, (1975).

Descriptors: *Legislation, *Drainage systems, Design criteria, *Urban drainage, *Water laws, *Cities, Standards, Training.
Identifiers: *South Africa.

Emphasis is placed on the need to update existing, or compile new, standard regulations and by-laws, with particular reference to drainage-system design. The importance of co-operation between the local authorities and the parties concerned with design and construction, is stressed. The hope is expressed that formal training of both building and drainage inspectors - on a national basis - will eventuate in the near future, and that a supplementary technical handbook be prepared, to serve as basis for a common code, thereby obviating possible misinterpretation. (South Africa)
W77-01485

UMGENI RIVER CATCHMENT ANALYSIS,
Department of Forestry, Pretoria (South Africa).
For primary bibliographic entry see Field 4D.
W77-01488

THE TUGELA-VAAL STATE PROJECT, (DIE TUGELA-VAAL STAATSWATERPROJEK),
Department of Water Affairs, Pretoria (South Africa).
T. P. C. Van Robbroeck.
LANTERN, Vol XXV (1), p 47-58, (1975).

Descriptors: Hydroelectric plants, *Pumped storage, Dam design, Flood control, Peak runoff, Damsites, *Inter-basin transfers, Resources development, Evaporation, Industrial water, Irrigation water, *Water supply, *Projects, *Multiple-purpose projects.
Identifiers: *Vaal River, Tugela river, Sterkfontein dam, Spioenkop dam, *South Africa.

Apart from supplying the bulk of the water to the Pretoria-Witwatersrand-Pretoria complex the Vaal river also has to provide in the water requirements of riparian owners, the Free State goldfields, the Vaal-Hartz Irrigation Project and many of the Northern Cape mining communities. To augment the inadequate water supplies of the Vaal river and interbasin transfer scheme brings water from the Tugela river across the Drakensberg escarpment into the head-waters of the Vaal river. The advantages of the scheme are explained and details of the Sterkfontein and Spioenkop Dams as well as the various tunnels, canals and pumping installations are given. Mention is also made of the pumped storage scheme that contributes 1000 MW to the national electricity network during peaking time. (South Africa)
W77-01490

'APPROACHES TO MULTI-OBJECTIVE PLANNING IN WATER RESOURCE PROJECTS,' BY BERNARD W. TAYLOR III, K. ROSCOE DAVIS, AND RONALD M. NORTH,
Cornell Univ., Ithaca, N. Y. Dept. of Environmental Engineering.
For primary bibliographic entry see Field 6B.
W77-01510

EVALUATION REPORT: WATER RESOURCES APPRAISAL FOR HYDROELECTRIC LICENSING. DAYTON DEVELOPMENT, PROJECT NO. 287, FOX RIVER, WISCONSIN AND ILLINOIS.
Federal Power Commission, Washington, D.C. Bureau of Power.
For primary bibliographic entry see Field 6F.
W77-01511

PROSPECTS OF HYDROMETRY IN THE LIGHT OF MODERN TECHNOLOGY,
International Commission on Irrigation and Drainage, New Delhi (India).
For primary bibliographic entry see Field 7B.
W77-01519

4B. Groundwater Management

THE IMPACT OF INCREASED ENERGY COSTS ON WATER USE AND AGRICULTURAL OUTPUT IN NORTHWESTERN OKLAHOMA,
Oklahoma State Univ., Stillwater. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 3F.
W77-01056

DEEP WELL WASTES MAY BE WATER HAZARDS.
For primary bibliographic entry see Field 5B.
W77-01083

WATER MANAGEMENT AND ADMINISTRATION IN THE SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT,
Florida Univ., Gainesville. School of Law.
For primary bibliographic entry see Field 6E.
W77-01101

HYDROGEOLOGY OF THE QUATERNARY AND TERTIARY FORMATIONS ALONG THE SOUTH COAST OF THE ALGARVE PORTUGAL,
Vrije Universiteit, Amsterdam (Netherlands). Inst. of Earth Sciences.
For primary bibliographic entry see Field 2F.
W77-01136

HYDRODYNAMICS OF PERCHED MOUNDS,
California State Univ., Fullerton. Dept. of Civil Engineering.
R. R. Brock.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 102, No. HY8, Proceedings Paper No. 12305, p 1083-1100, August 1976. 8 fig, 1 tab, 7 ref, 3 append.

Descriptors: *Artificial recharge, *Recharge ponds, *Perched water, *Water table, *Groundwater recharge, Groundwater, Permeability, Porous media, Hydraulics, Mathematical studies, Analysis, Aquifers, Saturated flow, Aquitards, Dupuit-Forchheimer theory, Equations.

Perched mounds develop beneath artificial groundwater recharge basins where one or more horizontal semipervious layers are located below the basin. The shape of perched mounds was investigated by use of the saturated flow equations and the Dupuit-Forchheimer approximation. Finite difference techniques were used to solve for the mound shape under rising and steady-state conditions beneath strip and circular basins. Analytical solutions were obtained for certain limiting conditions. Results for the maximum mound thickness were presented in the form of dimensionless curves involving permeability of semipervious layer and the soil above the layer, thickness of layer, effective porosity and recharge rate from the basin. The equations and assumptions used for a single layer were also used for a multiple layer situation. A computer program was developed for a three layer case, and its use was illustrated with a numerical example. (Adams-ISWS)
W77-01141

UNSTEADY GROUNDWATER FLOW BENEATH STRIP OCEANIC ISLANDS,
Wisconsin Univ., Madison. Dept. of Geology and Geophysics.
For primary bibliographic entry see Field 2F.
W77-01143

AQUIFER MANAGEMENT UNDER TRANSIENT AND STEADY-STATE CONDITIONS,
Stanford Univ., Calif. Dept. of Applied Earth Sciences.
W. M. Alley, E. Aguado, and I. Remson.
Water Resources Bulletin, Vol. 12, No. 5, p 963-972, October 1976. 4 fig, 1 tab, 7 ref.

Descriptors: *Aquifers, *Management, *Groundwater, *Linear programming, *Optimization, Wells, Distribution, Pumping, Decision making, Methodology, Constraints, Mathematical models, Equations, Systems analysis.
Identifiers: *Finite differences, *Steady-state flow.

The equations of transient and steady-state flow in two-dimensional artesian aquifers are approximated using finite differences. The resulting linear difference equations, combined with other linear physical and management constraints and a linear objective function, comprise a linear programming (LP) formulation. Solutions to such LP models are used to determine optimal well distributions and pumping rates to meet given management objectives for a hypothetical transient problem for a steady-state field problem. (Bell-Cornell)
W77-01169

LINEAR MODELS FOR GROUNDWATER MANAGEMENT,
Water Planning for Israel Ltd., Tel-Aviv.
J. Schwarz.
Journal of Hydrology, Vol. 28, No. 2/4, p 377-392, February 1976. 3 fig, 9 ref.

Descriptors: *Groundwater, *Management, *Water resources, *Linear programming, Economics, Aquifers, Storage, Hydraulics, Planning, Optimization, Constraints, Surface waters, Conjunctive use, Pumping, Mathematical models, Equations, Systems analysis.
Identifiers: *Influence model, *Transformation model, Superposition principle, Cost minimization, Benefit maximization.

Managing groundwater aquifers as storage systems may be formulated as a linear programming problem. In most cases, groundwater systems may be considered as linear systems. Standard and extended linear programming routines enable planning and management of complex systems, i.e., alternative users and sources, limited budgets, staged projects, and stochastic inputs. Described are the two different applications of linear programming to the management of groundwater: the one based upon influence equations and the one based on transformation equations. In conclusion, the transformation model is preferable for a small number of cells with time variations of the objective function or with ran-

dom variables such as natural replenishment. The influence model is less restricted by the number of cells but is less adaptable to time varying conditions. The transformation model is especially suited for evaluating operational rules of a conjunctive supply system with different sources and users. (Bell-Cornell)
W77-01180

THE GROUND WATER LEGAL REGIME AS INSTRUMENT OF POLICY OBJECTIVES AND MANAGEMENT REQUIREMENTS,
City Univ. of New York.
For primary bibliographic entry see Field 6E.
W77-01181

A SUBURBAN MODEL OF RATIONAL GROUND WATER UTILIZATION: A PLAN FOR NASSAU COUNTY,
City Univ. of New York.
R. White.
In: Proceedings of the International Conference on Water Law and Administration, International Association for Water Law, Feb. 8-14, 1976, Caracas, Venezuela; Published by the Commission for the National Water Resources Development Plan (Coplanarh), Caracas, Venezuela, p 310-330, 1976. 21 p, 2 fig, 20 ref.

Descriptors: *New York, *Water reuse, *Groundwater potential, *Groundwater mining, *Water yield, Water supply, Water table, Aquifers, Water policy, Water resources, Water balance, Aquifer systems, Aquifer management, Groundwater availability, Local governments, Water quality control.
Identifiers: *Nassau County.

Nassau County, located adjacent to New York City on Long Island, obtains all of its water supply from groundwater sources. There is, however, no regional or sub-regional plan for the utilization and protection of these resources. At the present time, they are being slowly exhausted. This paper proposes the implementation of a rational groundwater utilization plan. The general concept of recharging the ground water tables with treated waste water is a logical addition to the use of ground water replenishment reservoirs. Complete sewering should be implemented and unused cesspools drained. Cost, of course, is a factor. Present mining of the ground water reservoir should be recognized as temporary, since the water table level has been noticeably lowered in the past 15 years. This mining has also brought about the problem of saltwater intrusion. The two most hoped-for solutions are: (1) for Nassau County to renovate and recycle an amount of water equivalent to withdrawal in excess of permissive sustained yield; and (2) for Nassau County to work with Suffolk County, which has a water excess, for the establishment of a regional groundwater plan. (Frank-Florida)
W77-01182

METHOD FOR LOWERING GROUND WATER,
For primary bibliographic entry see Field 8B.
W77-01196

GEOTHERMAL ENERGY WELL CASING SEAL,
Sperry Rand Corp., New York, (Assignee).
For primary bibliographic entry see Field 8B.
W77-01205

PROGRESS IN THE EXPLORATION AND IN THE SCIENTIFIC RESEARCH OF THE LIBYAN DESERT SINCE GERHARD ROHLFS,
Stuttgart Univ. (West Germany).
For primary bibliographic entry see Field 4A.
W77-01269

A SIMPLE COMPUTER PROGRAM FOR THE DETERMINATION OF AQUIFER CHARACTERISTICS FROM PUMP TEST DATA,
Southwest Florida Water Management District, Brooksville.
For primary bibliographic entry see Field 7C.
W77-01337

COMPARATIVE EFFICIENCY OF GEOPHYSICAL PROSPECTING TECHNIQUES IN WATER-SATURATED SANDS,
National Physical Research Lab., Pretoria (South Africa).
For primary bibliographic entry see Field 2F.
W77-01361

GEOPHYSICAL EXPLORATION FOR POTABLE GROUNDWATER SUPPLIES IN THE KALAHARI GEMSBOK NATIONAL PARK,
Ruker (Richard) and Associates, Bryanston (South Africa).
E. Martinelli.
Water SA, Vol. 1, No. 2, p 53-56, July 1975. 3 fig, 1 tab, 1 ref.

Descriptors: *Borehole geophysics, Potable water, *Groundwater, *Resistivity, Water quality, Water supply, National parks, *Exploration, Saline water, Deserts, Africa.
Identifiers: *South Africa, Kalahari Desert.

A successful geoelectric case history of prospecting for groundwater near Nossob Camp, Kalahari Gemsbok National Park, is described with particular reference to the delineation of zones of good groundwater quality. The resistivity method, used in conjunction with hydrogeological investigations has been demonstrative in locating and delineating fresh water body overlying and contained within a marginal saline water environment. (South Africa)
W77-01366

GROUND-WATER DATA FOR THE SANTA MARIA VALLEY, CALIFORNIA,
Geological Survey, Menlo Park, Calif.
J. L. Hughes, and J. R. Freckleton.
Open-file report, May 1976. 444 p, 12 fig, 5 tab.

Descriptors: *Groundwater, *Basic data collections, *Water wells, *Water levels, *Water quality, Chemical analysis, Pumping, Drawdown, Water yield, Specific capacity, Water level fluctuations.
Identifiers: *Santa Maria Valley(Calif), *Well hydraulics.

In 1968 the U. S. Geological Survey began organizing in computer format ground-water data in the Santa Maria Valley, Calif., in cooperation with the California Water Resources Control Board, Central Coast Region, and the Santa Barbara County Water Agency. The valley covers an area of about 260 sq mi and includes the towns of Santa Maria, Orcutt, and Guadalupe. The principal industries are agriculture, oil production, and sugar-beet refinement. This compilation makes available well records, ground-water-quality data, water levels, and well-hydraulics data, which will be useful in future water-resources planning. (Woodard-USGS)
W77-01415

STATISTICAL ANALYSIS OF WATER-LEVEL SPRINGFLOW, AND STREAMFLOW DATA FOR THE EDWARDS AQUIFER IN SOUTH-CENTRAL TEXAS,
Geological Survey, Austin, Tex.
C. Puente.
Edwards Underground Water District Report, July 1976. 58 p, 19 fig, 4 tab, 10 ref.

Descriptors: *Statistical methods, *Water levels, *Aquifers, *Springs, *Streamflow, Forecasting, Flow rates, Equations, Regression analysis, Hydrology, Groundwater movement.
Identifiers: *Edwards aquifer(Tex).

Water-level, springflow, and streamflow data were used to develop simple and multiple linear-regression equations for use in estimating water levels in wells and the flow of three major springs in the Edwards aquifer in the eastern San Antonio, Texas, area. The equations provide daily, monthly, and annual estimates that compare very favorably with observed data. Analyses of geologic and hydrologic data indicate that the water discharged by the major springs is suppled primarily by regional underflow from the west and southwest and by local recharge in the infiltration area in northern Bexar, Comal, and Hays Counties. Underflow from the artesian aquifer west of San Marcos Springs may account for 97 percent of the springflow during periods of extreme drought (1947 to 1956) and only 46 percent during wet periods (1973). On a monthly basis, the underflow component ranges from 40 to 100 percent of the total springflow. From January 1950 to December 1974, the underflow components accounted for about 60 percent of the total discharge of San Marcos Springs. A hydrograph shows monthly average discharge of the Blanco River at Wimberly, Texas, from 1934 to 1973. This stream is representative of the streams draining the Edwards Plateau in the study. (Woodard-USGS)
W77-01417

ESTIMATED GROUNDWATER YIELD FOLLOWING STRIP CUTTING IN PINE PLANTATIONS,
Forest Service (USDA), Cadillac, Mich. North Central Forest Experiment Station.
For primary bibliographic entry see Field 4C.
W77-01426

HYDROGEOLOGICAL AND GEOPHYSICAL INVESTIGATIONS OF A GEOTHERMAL ANOMALY IN HUNGARY; II. GEOTHERMAL FLOW SYSTEM IN THE TISZAKECSKE REGION,
Research Inst. for Water Resources Development, Budapest (Hungary).
L. Alfoldi, M. Erdelyi, J. Galfi, K. Korim, and P. Liebe.
Hydrological Sciences Bulletin, Vol 21, No 2, p 301-313, June 1976. 8 fig, 1 tab, 5 ref.

Descriptors: *Geothermal studies, *Boreholes, Reservoirs, Hydrogeology, *Geophysics, Wells, Sedimentary rocks, Sands, Gravels, Water yield, Drilling.
Identifiers: *Hydrogeological investigation, *Tiszakecske region(Hungary), *Hungary, Geothermal flow system, Thermal reservoir system, Geothermal wells, Thermal water chemistry.

The thermal water reservoir system which was developed by boreholes in recent years around Tiszakecske and Lakitelek was subjected to intense investigation. The study confirmed and extended the knowledge of the geothermal anomaly revealed previously in Part I of this report (Alfoldi and Galfi, 1966). The development of this warm water geothermal field was carried out through ten exploratory and extension wells. Their depths ranged from 250 to 2048 m and penetrated a sedimentary sequence of Quaternary-Pliocene-Miocene age. The areal extent of the study area was approximately 150 sq km. Two thermal water reservoir systems could be distinguished: an upper formation consisting of sand and gravel of Quaternary age, and a deeper formation including a sand series of Pliocene age. In analyzing the major reservoir parameters and pressure-volume-temperature relations and considering the geological conditions, a communication between the two reservoir systems was supposed. The local, near-surface geothermal anomaly was due to ascending, relatively warm water from the deeper thermal water layer under special geological, hydrodynamic, and thermodynamic conditions. By com-

parison, in the southern part of the study area, a negative geothermal anomaly was found to be influenced by the descending cold water of meteoric origin. (Roberts-ISWS)
W77-01436

PINPOINTING BOREHOLES ELECTRICALLY.
For primary bibliographic entry see Field 2F.
W77-01448

EVALUATION OF GEO-HYDROLOGIC CONSTANTS FOR THE FAR WEST RAND DOLOMITIC FORMATIONS,
University of the Witwatersrand, Johannesburg (South Africa). Dept. of Civil Engineering.
H. J. Schwartz, and D. C. Midgley.
The Civil Engineer in South Africa, Vol 17 (2), p 31-36, 178-180, (1975). 9 fig, 3 tab, 5 ref.

Descriptors: Dolomite, Groundwater basins, Subsurface waters, Hydrogeology, Groundwater storage, Groundwater movement, Dewatering, Mines.
Identifiers: South Africa, West Driefontein Mine, Bank compartment.

Following the sudden inrush of water into the West Driefontein mine in October 1968, an analysis based on the Theis non-equilibrium approach was carried out to determine the transmissivity and storativity of the dolomitic formations of the Bank Compartment which has an exposed areal extent of 156 km2 and a thickness of about 1000 m. Details of the analysis are given and the predicted response of the water table is compared with that obtained in the subsequent dewatering operations in the compartment which revealed Sevealed geologic inhomogeneities. (South africa.
W77-01449

SAND 'SPONGE' WILL STORE RECLAIMED WATER.
Construction in Southern Africa, Vol 20 (5), p 61-62, (1975).

Descriptors: *Sand aquifers, *Water storage, *Water reuse, Water purification, Financing, Droughts, Water supply.
Identifiers: *South Africa, Cape Flats.

Reclaimed water from purified sewage may soon be stored for future use in the natural reservoir formed by sand deposits on the Cape Flats, which act as a gigantic sponge. This possibility, which will counteract droughts in the Cape Peninsula, has arisen from research carried out by the CSIR's National Institute for Water Research, on behalf of the Water Research Commission. Progressive integration of reclaimed water into present water supply systems will boost the amount of water that can be reclaimed from 50 Ml per day in 1978 to 425 Ml per day by the year 2000, which would be equivalent to nearly 50 per cent more than the present fresh water demand in the Cape Peninsular. Two of the attractions of the Cape Flats aquifer as a water supply source are its close proximity to both consumers and sewage purification plants, and the buffer capacity provided by its tremendous storage capacity. The latter is sufficient to satisfy the entire demand of Cape Town and environs for more than three years without any natural or artificial recharge taking place. (South Africa)
W77-01451

4C. Effects On Water Of Man's Non-Water Activities

FUTURE CHEMICAL COMPOSITION OF THE GREAT SALT LAKE BRINES,
Brigham Young Univ., Provo, Utah.
For primary bibliographic entry see Field 2H.
W77-01053

URBAN STORM WATER RUNOFF: A TWO-FOLD PROBLEM,
Florida Univ., Gainesville. School of Law.
For primary bibliographic entry see Field 6E.
W77-01098

REDEVELOPMENTS ON THE OCEANFRONT,
Florida Univ., Gainesville. School of Law.
For primary bibliographic entry see Field 6E.
W77-01100

SETTLEMENTS IN THE RAJASTHAN CANAL IRRIGATION AREA, INDIA,
B. D. Bhattacharya.
Ekistics, Vol. 41, No. 242, p. 46-49, January, 1976. 5 fig, 2 tab.

Descriptors: *Human population, *Irrigation canals, *Relocation, *Deserts, Comprehensive planning, Rural areas, Area redevelopment, Social aspects, Asia, Irrigated land.
Identifiers: *India, *Rajasthan.

Relocation and settlement of from 2 to 2.5 million people in an irrigated area of desert land in India near the border with Pakistan is discussed. Mean average rainfall varies from 150 mm to 400 mm and water is the major limiting factor to development of the area. The Rajasthan Canal will bring water to irrigate about 2 million hectares of desert land, thus far the canal network has reached halfway. 400,000 hectares of land have been permanently alloted to cultivators, enabling 80,000 families to settle. Article discusses the basic plan for the layout of villages, market towns, crop production and transportation network. Population in the area has doubled from 200,000 in 1961 when the first water was released to 400,000 in 1975. (Jamail-Arizona)
W77-01272

SALT STORAGE AND RUNOFF IN URBAN WATERSHED,
Utah State Univ., Logan. Watershed Science Unit; and Utah State Univ., Logan. Dept. of Forestry and Outdoor Recreation.
For primary bibliographic entry see Field 5B.
W77-01336

IS MAN CHANGING THE WEATHER.
National Center for Atmospheric Research, Boulder, Colo.
For primary bibliographic entry see Field 3B.
W77-01353

CATCHMENT RESEARCH AT ZACHARIASHOEK,
Jonkershoek Forest Research Station, Stellenbosch (South Africa).
For primary bibliographic entry see Field 4D.
W77-01386

HYDROLOGIC DATA FOR URBAN STUDIES IN THE HOUSTON, TEXAS METROPOLITAN AREA, 1974,
Geological Survey, Austin, Tex.
For primary bibliographic entry see Field 7C.
W77-01419

ESTIMATED GROUNDWATER YIELD FOLLOWING STRIP CUTTING IN PINE PLANTATIONS,
Forest Service (USDA), Cadillac, Mich. North Central Forest Experiment Station.
D. H. Urie.
Water Resources Research, Vol. 7, No. 6, December 1971, p. 1497-1510. 11 fig, 2 tab, 15 ref.

Descriptors: *Groundwater, Streamflow, Vegetation, *Base flow, Pine trees, Water yield, *Jack Pine Trees.
Identifiers: *Strip cutting.

Groundwater recharge balances were determined under 40-acre of blocks of a jack pine (Pinus banksiana Lamb) plantation in northwestern lower Michigan during the 4 years following te removal of 50% of the trees in clear-cut strips. Analyses were made by graphical interpretation of diurnal fluctuations and by use of finite difference equations. In the numerical method, weekly water table elevation measurements over each 40-acre block were used to determine water table convexity, which was then linearly related to the groundwater inflow-outflow balance. Results from both methods of analysis showed the effect of strip cutting as increased groundwater yields. Estimates of water yield by the two methods differed primarily as a result of poor estimates of net evaporative loss from the saturated zone using the graphical method. Three other tests of cutting effects on groundwater recharge supported the budget estimates of treatment effect. Approximately 3 inches per year of additional water was produced as a result of the strip cut during the first 4 years after cutting. The numerical analysis showed that the amount of treatment effect decreased rapidly over this period. (Forest Service)
W77-01426

NATURAL FILTERING OF SUSPENDED SOIL BY A STREAM AT LOW FLOW,
Forest Service (USDA), Corvallis, Oreg. Pacific Northwest Forest and Range Experiment Station.
N. H. Miner.
Research Note, PNW-88, September 1968, 4 p, 1 fig, 2 ref.

Descriptors: *Filtration, *Suspended solids, *Sediments, Low flow, Soil erosion, Streamflow, Road construction, *Soil management.

During road construction soil that is added to a stream by tractors crossing during low flow is temporarily 'filtered' out before it travels far. Five-gallon samples were taken at 150, 300, 600, 1,200 feet downstream from a road crossing, with sodium fluorescein dye used as a tracer. Suspended particle concentration was reduced from 1,055 p.p.m. at 150 feet below the road to 108 p.p.m. at 1,200 feet. The 'filtering' action is a combination of settling larger particles and dilution of sediment-laden water. This filtration is temporary and deposited soil will tend to be flushed downstream during high flows and may cause channel erosion or other damage. (Forest Service)
W77-01428

TIMBER AND WATER,
C. L. Wicht.
South African Forestry Journal, 85, p 3-11, (June 1974). 4 fig, 44 ref.

Descriptors: Drainage basins, *Forest management, Wildlife management, Ecology, Transpiration, *Lumbering, Water yield, *Watershed management, Watersheds(Basins).
Identifiers: South Africa, Drakensberg, Jonkershoek.

A discussion is presented of the management measures that can be applied in mountain catchments if timber and/or water production are the objectives of the management concerned. Catchments are managed by applying knowledge of ecology, engineering and concomitant branches of science, in silvicultural practice, pasture management, wildlife conservation and outdoor recreation. The catchments considered are typical of those found in humid, cool-temperate and warm-temperate forest regions. Also discussed are timber production from the catchments, water yield from the catchments and coordination of results from the catchment experiments. (South Africa)

W77-01480

4D. Watershed Protection

COOPERATIVE CONTROL OF INTERNATIONAL POLLUTION AND COMMON PROPERTY RESOURCES,
University of Western Ontario, London.
For primary bibliographic entry see Field 5G.
W77-01290

COFFEE POND WATERSHED MANAGEMENT PLAN.
Maine Dept. of Environmental Protection, Augusta. Bureau of Water Quality Control.
For primary bibliographic entry see Field 5G.
W77-01292

FOREST LAKE WATERSHED MANAGEMENT PLAN.
Maine Dept. of Environmental Protection, Augusta. Bureau of Water Quality.
For primary bibliographic entry see Field 5G.
W77-01293

A HYDRO-ECONOMIC EVALUATION OF FORESTRY IN THE EERSTE RIVER CATCHMENT,
Department of Forestry, Pretoria (South Africa).
For primary bibliographic entry see Field 4A.
W77-01368

AFFORESTATION, CATCHMENT PROTECTION AND WATER SUPPLY DEMANDS,
Australian National Univ., Canberra. Dept. of Forestry.
D. M. Stodart.
South African Forestry Journal, No. 93, p. 12-20, (1975). 7 fig, 2 tab, 7 ref.

Descriptors: Drainage basins, Forest management, Management, *Vegetation effects, Streamflows, *Forest watersheds, *Watershed management, Watersheds(Basins), *Water demand, Water supply.
Identifiers: *South Africa.

The author contends that the vegetation cover of a catchment is a significant factor determining the behaviour of the catchment and that it influences the total water yield of the catchment, the flood and drought flows associated with water yields, the risk of erosion and the quality of the water. He takes a look at the effects of plant cover on stream-flow, at the management of catchment vegetation and reservoir behaviour and catchment management policies and water supply demand. He comes to the conclusion that the significance of the effects of treatment of the vegetation of mountain catchments either by replacing it with plantations or by prescribed burning can be assessed in relation to both the patterns of the water supply demand and the provision of storage to regulate streamflow. (South Africa)
W77-01371

ALLOCATION OF WATER TO FORESTRY AND OTHER USERS IN THE CATCHMENT OF THE EERSTE RIVER,
Jonkershoek Forest Research Station, Stellenbosch (South Africa).
D. W. Van Der Zel, and C. L. Wicht.
Forestry in South Africa, No. 15, p. 47-55, July 1974.

Descriptors: *Burning, Rainfall-runoff relationships, *Evapotranspiration, River basins, Irrigation, *Watershed management, Water allocation(Policy), *Water distribution(Applied), Systems analysis, Forest management.
Identifiers: *South Africa, *Eerste River, *Fynbos.

A system analysis of the water component within the Eerste River catchment in the Stellenbosch District, Cape Province South Africa, is presented. Input of water from rain, and output through vapour losses and discharge to the sea, are compared. One third of the output is attributed to vapour losses from fynbos and about the same from irrigation, while one fifth flows to the sea. Much water could be saved by treatment of the fynbos (controlled burning) and by improved irrigation. Expansion of research into restriction of vapour losses is recommended. (South Africa)
W77-01385

CATCHMENT RESEARCH AT ZACHARIASHOEK,
Jonkershoek Forest Research Station, Stellenbosch (South Africa).
D. W. Van Der Zel.
Forestry in South Africa, No. 15, p. 23-30, June 1974. 5 fig, 4 tab, 14 ref.

Descriptors: *Burning, Geology, Vegetation, *Evaportranspiration, River basins, Hydrography, Streamflow, River flow, Water yield, Forest management, Rainfall-runoff relationships, *Watershed management, Water quality, Watershed(Basins)
Identifiers: *South Africa, Klein Drakenstein Mountains.

In this first paper in a series on research, five Zachariashoek research catchments, situated in the Klein Drakenstein Mountains of the south-western Cape, are described. Preliminary rainfall figures are included and the topography, geology, vegetation and hydrography are explained. Treatments consist of periodic burning of catchment areas of about 250 ha each on rotations of four and 12 years. Water quantity, regime and quality are regularly measured. Vegetation composition is regularly observed on 50 m2 quadrats and phytomass yields are estimated. Research results should be applicable to a considerable area of mountain catchments in the south-western Cape. (South Africa)
W77-01386

MUNICIPAL WATERSHED MANAGEMENT SURVEY,
Forest Service (USDA), Franklin, N.C. Coweeta Hydrologic Lab.
G. E. Dissmeyer, and W. T. Swank.
Journal of the American Water Works Association, Vol 68, No 2, p 97-100, February 1976. 10 tab, 5 ref.

Descriptors: *Municipal water, *Watershed management, *Small watersheds, *Surveys, Data collections, Forest management, *Southeast US, *Land use, *Forest watersheds.

Based on survey data, a general summary is provided of the nature and extent of land uses, management problems, and informational needs for municipal watersheds in the southeastern US. Emphasis is placed on small and heavily forested watersheds and related forestry activities. (Forest Service)
W77-01422

THE RELATIONSHIP BETWEEN NITRATE CONCENTRATIONS IN THE SOUTHERN APPALACHIAN MOUNTAIN STREAMS AND TERRESTRIAL NITRIFIERS,
Forest Service (USDA), Franklin, N.C. Coweeta Hydrologic Lab.
For primary bibliographic entry see Field 5B.
W77-01423

CLEARING AN ALLIGATOR JUNIPER WATERSHED WITH SAWS AND CHEMICALS: A COST ANALYSIS,
Forest Service (USDA), Fort Collins, Colo. Rocky Mountain Forest and Range Experiment Station.
R. L. Miller.
Research Note RM-183, 1971, 8 p, 4 fig, 6 tab, 11 ref.

Descriptors: *Forest management, Economics, *Watershed management, *Cost analysis, *Juniper trees, Operational costs.
Identifiers: *Alligator juniper watershed conversion.

Manpower, equipment, materials, and vehicle input data were analyzed for seven component jobs involved in an experimental conversion of an alligator juniper watershed to herbaceous cover. Total operational cost was $45.02 per acre. Analysis indicates that costs may be reduced substantially in an operational program through improved organization, changing prescriptions and techniques, and further cost studies. (Forest Service)
W77-01430

STREAMFLOW NITROGEN LOSS FOLLOWING FOREST EROSION CONTROL FERTILIZATION,
Forest Service (USDA), Portland, Oreg. Pacific Northwest Forest and Range Experiment Station.
G. O. Klock.
Research Note PNW-169, November 1971, 10 p, 3 fig, 10 ref.

Descriptors: *Fertilization, Streamflow, *Soil erosion, *Erosion control, *Nitrogen, *Watershed management, *Washington.

Three gaged watersheds, approximately 500 hectares in size, in north central Washington were severely burned in 1970 wildfire. In an experimental erosion control seeding program, two watersheds were fertilized, one with urea and the other with ammonium sulfate. The third watershed was retained as an unrehabilitated control. For a 60-day period during and following fertilization, 1.37 kilograms of urea-N and 2.90 kilograms of nitrate-N were estimated to have been carried by streamflow from the watershed fertilized with 27.5 metric tons of elemental nitrogen as urea. On the watershed fertilized with 33.16 metric tons of elemental nitrogen as ammonium sulfate, 1.45 kilograms of nitrate-N was estimated to have been transported from the watershed by streamflow. (Forest Service)
W77-01431

SEVENTEEN-YEAR SEDIMENT PRODUCTION FROM A SEMIARID WATERSHED IN THE SOUTHWEST,
Forest Service (USDA), Fort Collins, Colo. Rocky Mountain Forest and Range Experiment Station.
E. F. Aldon, and G. Garcia.
Research Note RM-248, September 1973, 4 p, 1 fig, 1 tab, 9 ref.

Descriptors: *Erosion control, *Sediments, *Watershed management, Litter, Southwest US, *New Mexico, Flood plains, Semiarid areas.
Identifiers: Rio Puerco(N Mex).

Average annual rate of sediment production declines 71 percent in the period 1967-71 compared with the period 1956-66 on a 471-acre watershed on the Rio Puerco drainage in New Mexico. This decline was a result of an increase in plant size and litter production on the alluvial flood plain. (Forest Service)
W77-01433

MAXIMUM PEAK FLOW FOR SELECTED RETURN PERIODS FOR WATERSHEDS WEST OF THE CONTINENTAL DIVIDE IN IDAHO AND MONTANA,
Forest Service (USDA), Ogden Utah. Intermountain Forest and Range Experiment Station.
N. Bethlahmy.
Research Paper INT-113, 1971, 12 p, 3 tab, 8 ref.

Descriptors: *Watershed management, *Peak discharge, *Idaho, *Montana, Water yield.

The long-term average water yield of a watershed appears to be a good index to the magnitude of its expected peak flow. On the basis of this relation, tables are presented showing expected peak flows that are applicable to watersheds in Idaho and Montana west of the Continental Divide. Tabulated peak flows are for four different return periods: mean annual; 5; 10; and 20 years. Three examples are given to illustrate the tables' field application. (Forest Service)
W77-01435

RESULTS OF THE MULTIPLE CATCHMENT EXPERIMENTS AT THE JONKERSHOEK RESEARCH STATION, SOUTH AFRICA. 2. INFLUENCE OF PROTECTION OF FYNBOS ON STREAM DISCHARGE IN LANGRIVIER,
Jonkershoek Forest Research Station, Stellenbosch (South Africa).
D. W. van der Zel, and F. J. Kruger.
Forestry in South Africa, No 16, p 13-18, (1975). 3 fig, 2 tab, 27 ref.

Descriptors: River basins, Watersheds(Basins), River flow, *Water yield, Transpiration, *Watershed protection, Africa.
Identifiers: Lang River, *South Africa, *Fynbos, *Langrivier.

Protection of an upland fynbos catchment in the winter-rainfall of South Africa resulted in a one per cent decrease in streamflow per year of protection. Annual streamflow declined about 500 mm during the 25 years after an accidental fire in December 1942. The decrease can be ascribed entirely to diminution in streamflow during the months April to November. No change was detected in dry-season flow. The decrease in streamflow is ascribed to increased transpiration and interception losses arising from increases in phytomass. The decline is substantial and points to the need for scientific management of South African mountain catchments to provide a higher constant water yield. (South Africa)
W77-01474

UMGENI RIVER CATCHMENT ANALYSIS,
Department of Forestry, Pretoria (South Africa).
D. W. Van Der Zel.
Water SA., 1(2), 70-75 (1975).

Descriptors: System analysis, Land use, *River basins, Watersheds(Basins), *Watershed management, *Water utilization, Management, Planning.
Identifiers: South Africa, *Umgeni River, *Natal.

The Umgeni River catchment is analysed as a system, determining how the water is being used within this important Natal river catchment. Analysis of this nature also brings to the fore the relative impact of different present and prospective land and water uses on the community as a whole. Catchment systems analysis is shown to be a simple but effective way to assist planners and decision makers arrive at dynamic and conclusive recommendations for consistent development along sound ecological and economical lines. (South Africa)
W77-01488

VORTEX VELOCITY PREDICTION WITH EMPHASIS DIRECTED TOWARD VORTEX TUBE SEDIMENT TRAP DESIGN,
Nebraska Univ., Lincoln. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 8B.
W77-01520

5. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification Of Pollutants

MIXED FUNCTION MONOOXYGENASE OF FISH AS AN INDICATOR OF POLLUTION OF AQUATIC ENVIRONMENT BY INDUSTRIAL EFFLUENT,
Oulu Univ. (Finland). Dept. of Pharmacology.
For primary bibliographic entry see Field 5C.
W77-01065

INSTALLATIONS FOR MONITORING OIL CONTENT,
Bailey Meters and Controls Ltd., Croydon (England). (Assignee).
R. M. deVial.
U. S. Patent No 3,965,920, 9 p, 4 fig, 2 ref; Official Gazette of the United States Patent Office, Vol 947, No 5, p 2025, June 29, 1976.

Descriptors: *Patents, *Monitoring, *Control systems, *Oil pollution, *Oily water, *Pollutant identification, Water pollution, Control systems, Ultraviolet radiation, Equipment.
Identifiers: Ballast water, Tankers, Photo-electric cells.

Installations for monitoring oil content in a stream of water, and more particularly, in a discharge of water ballast from cargo tanks of an oil tanker are described. The installation for monitoring the oil content in a stream of water includes a sampling connection connected to receive a flow of water, an emulsifier connected to receive a fraction of the flow of water from the sampline connection and discharge the fraction, after thorough mixing, to a number of downward discharging orifices having co-planer axes of discharge in a sampling chamber. A beam of ultraviolet radiation of wavelength in the range 200 to 400 n.m. is arranged to be incident upon jets discharged from the orifices. A photo-electric cell receives fluorescent radiation emitted from the jets at wavelengths greater than 400 n.m. An alarm circuit arranged upon the photo-electric cell receiving radiation greater than a predetermined value energises a pneumatically operated alarm system by benting a pneumatic pilot pressure line. (Sinha-OEIS)
W77-01195

OIL-IN-WATER MONITOR,
M. G. Grant.
U.S. Patent No. 3,966,603, 6 p, 2 fig, 6 ref; Official Gazette of the United States Patent Office, Vol 947, No 5, p 2246, June 29, 1976.

Descriptors: *Patents, *Monitoring, *Oil pollution, *Oily water, *Water pollution sources, *Pollutant identification, Sensors, Equipment, Effluent streams.
Identifiers: Bilge water.

A system for monitoring oil in water which is being transferred from a first to a second location is described. Monitors are needed to ascertain that the separator is performing its function properly, and that the oil in the effluent bilge water is less than a predetermined amount. A pressure vessel coalesces oil from the effluent and gathers the oil in a collection section which is automatically emptied after an hour. If more than a predetermined amount of oil is gathered in the hour, an oil-sensing probe sends a signal to activate a warning light valve which permit pipes to return the effluent to the separator. If the effluent becomes too turbid, a turbidity senser activates an alarm and the valves which permit pipes to return the effluent to the separator. If the coalescer unit clogs, an indication is given by a differential pressure gauge. (Sinha-OEIS)
W77-01201

OCEANOGRAPHIC APPARATUS,
General Dynamics Corp., St. Louis, Mo. (Assignee).
For primary bibliographic entry see Field 2L.
W77-01214

KEPONE: HAZARD TO AQUATIC ORGANISMS,
Environmental Protection Agency, Gulf Breeze, Fla. Gulf Breeze Lab.
For primary bibliographic entry see Field 5C.
W77-01235

MODIFIED BIOASSAY PROCEDURE FOR TOXIC EFFLUENTS,
Jyvaskyla Univ. (Finland). Dept. of Biology.
V. Eloranta.
Journal of Water Pollution Control Federation, Vol. 47, No. 8, p. 2172-2177, August 1975. 4 fig., 12 ref.

Descriptors: *Methodology, *Analytical techniques, *Bioassay, *Algae, Laboratory tests, *Toxicity, *Sulfur compounds, *Sulfite liquors, *Industrial wastes, Photosynthesis, Spectrophotometry, Growth rates, Mortality, Water pollution effects, Effluents, Liquid wastes, *Pollutant identification, *Bioindicators.
Identifiers: *Ankistrodesmus sp., Sulfite-lye.

The alga, Ankistrodesmus falcatus var. acicularis was used in a bioassay experiment to determine the toxicity of sulfite-lye at four dilutions. Effluents were added to the cultures when logarithmic growth had been reached after 5 to 7 days. During the light period a mixture of air and 6 percent CO2 was fed into the flasks to maintain a neutral pH. The growth of algae was followed by measuring the chlorophyll a content of the cultures daily. The sulfite lye was found to kill the algae or inhibit their growth at all concentrations used. (Katz)
W77-01243

AROMATIC HYDROCARBONS IN AQUATIC FAUNA,
Atlantic Biological Station, St. Andrews (New Brunswick).
V. Zitko.
Bulletin of Environmental Contamination and Toxicology, Vol. 14, No. 5, p. 621-631, 1975. 2 tab., 4 fig., 12 ref.

Descriptors: *Analytical techniques, *Fluorometry, *Pollutant identification, *Chemical analysis, Creosote, Oil, *Oil pollution, *Aromatic compounds, *Shellfish, Aquatic animals, *Testing procedures, Organic compounds, Oil wastes, Oil spills, Water pollution sources, Methodology, Monitoring.

A rapid method for screening of aquatic fauna for the presence of polynuclear aromatic hydrocarbons is described. The mixture of hydrocarbons is separated from lipids by column chromatography on alumina, characterized and quantitated by fluorometry with pyrene as a fluorescence standard. The method can be used to detect contamination of aquatic fauna by crude oil, fuel oils, and creosote oil. The detection of crude, Bunker C, and creosote oil in the described method is approximately 100, 50, and 100 microgram/gram lipid, respectively. Polynuclear aromatic hydrocarbons of these oils were not detectable in samples of fish and seals. Creosote oil in concentrations ranging from 202 to 3254 micrograms/gram lipid was detected in the samples of shellfish. (Katz)
W77-01247

HEAVY METAL AND CHLORINATED HYDROCARBON RESIDUES IN CALIFORNIA

SEA LIONS (ZALOPHUS CALIFORNIANUS CALIFORNIAUS),
Oregon State Univ., Corvallis. Dept. of Agricultural Chemistry.
For primary bibliographic entry see Field 5C.
W77-01261

OPTIMUM ALLOCATION STRATEGIES FOR SAMPLING BENTHOS IN THE NEW YORK BIGHT,
Rhode Island Univ., Kingston. Marine Experiment Station.
S. B. Saila, R. A. Pikanowski, and D. S. Vaughan.
Estuarine and Coastal Marine Science, Vol. 4, No. 2, p. 119-128, 1976. 1 fig., 2 tab., 5 ref.

Descriptors: *Sampling, *Methodology, *Analytical techniques, *Optimization, Assay, *Testing procedures, Project planning, Trace elements, Invertebrates, Mathematical studies, *Benthos, *Bioassay, Pollutant identification.
Identifiers: *Marine ecosystems analysis, *New York Bight, Cerianthus americanus.

Sampling plans based on historical data available from the Marine Ecosystems Analysis (Mesa) New York Bight Project are described and illustrated. These plans provide the requisite levels of precision for the minimum expenditure of time and effort. Sampling for a single variable such as selected trace elements is optimized directly. Sampling for several variables simultaneously in a two-stage scheme can also be optimized. The optimization procedure is explained and illustrated in detail and results for a realistic case are given. Relatively few replicates (approximately five) are shown to be required to test reasonably defined hypotheses concerning differences in trace elements between two stations. Sample sizes for seven species were determined and a compromising allocation is discussed. (Katz)
W77-01264

CHRONIC EFFECTS OF REDUCED PH ON BROOK TROUT (SALVELINUS FONTINALIS),
West Virginia Dept. of Natural Resources Elkins. Div. of Wildlife Resources.
For primary bibliographic entry see Field 5C.
W77-01266

MERCURY IN EGGS OF NORWEGIAN SEABIRDS,
Tromsoe Univ. (Norway). Inst. Biology and Geology.
N. Fimreite, E. Brun, A. Froslie, P. Frederichsen, and N. Gundersen.
Astarte, Vol. 7, no. 2, p. 71-76, 1974. 1 fig., 6 tab., 21 ref.

Descriptors: *Mercury, *Bird eggs, *Gulls, *Heavy metals, *Path of pollutants analytical techniques, Metals, Reproduction, Food chains, Food webs, Gas chromatography, Hatching.
Identifiers: *Larus spp., *Norway, Uria spp., Alca spp. Rissa spp., Sula spp. Guillemot, Razorbill, *Seabird eggs.

Seabird eggs from nine locations along the coast of Norway were sampled for mercury content. Mercury levels in Herring Gull eggs from sites below 59 degrees north latitude, averaged 0.34 ppm. From northern localities eggs of Herring Gull (Larus argentatus), Guillemot (Uria aalge), and razorbill (Alca torda) contained less than 0.10 ppm, eggs of Kittiwake (Rissa tridactyla) less than 0.15 ppm, and the Gannet (Sula bassana) 0.58 ppm, all average values. More than 90 per cent of the mercury was in methyl form. (Katz)
W77-01267

A NEW METHOD FOR THE DETERMINATION OF NITRATES IN DRINKING WATER,
Assis Ltd., Ramat Gan (Israel).
J. I. Monselise.
Isr J Technol. 11(3), p 163, 1973.

Descriptors: *Potable water, *Nitrates, *Measurement, Water pollution sources, Spectrometers, Spectrophotometry, *Pollutant identification, Analytical techniques.
Identifiers: *UV spectrophotometry.

An UV spectrophotometric method based on measurement of absorbance at 220 nm was devised and applied to measurements of nitrate concentrations in drinking water samples.--Copyright 1975, Biological Abstracts, Inc.
W77-01278

WORKSHOP ON TOXICITY TO BIOTA OF METAL FORMS IN NATURAL WATER.
International Joint Commission-United States and Canada.
For primary bibliographic entry see Field 5C.
W77-01295

ZINC SPECIATION AND TOXICITY TO FISHES,
Montana State Univ., Bozeman. Dept. of Chemistry.
For primary bibliographic entry see Field 5C.
W77-01298

MOLECULAR FORMS OF ARSENIC IN THE ENVIRONMENT,
University of South Florida, Tampa. Dept. of Chemistry.
R. S. Braman.
In: International Joint Commission's Workshop Proceedings 'Toxicity to Biota of Metal Forms in Natural Water', October 7-8, 1975, Duluth, Minn. p. 249-261. April 1976. 3 fig., 4 tab., 7 ref. NSF (RALNN) GI-43753 and AEN 75-14278.

Descriptors: *Arsenic compounds, *Analytical techniques, *Pollutant identification, Freshwater, Sea water, Sodium arsenite, Reduction(Chemical), Air environment.
Identifiers: Inorganic arsenic(III), Methylarsenic acid, Dimethylarsenic acid, Trimethylarsine oxides.

Described is an analytical technique which can determine down to approximately 0.02 ppb or 1 ng ambient concentrations of inorganic arsenic (III), arsenic (V), methylarsenic acid, dimethylarsenic acid, and trimethylarsine odide type compounds in freshwater, seawater, and air. Based upon observation of arsenic atomic emission lines in a d.c. dicharge, the method also involves the separation of arsine and methyl arsines after reduction of corresponding arsenic compounds by sodium borohydride. Acidity of the reduction conditions is important and is used to differentiate between arsenic (III) and (V). The various arsenic acids must also be completely protonated before they can be reduced to the corresponding arsines. Arsenic appears to be higher in lakes or ponds surrounded by fertilized lawns and which have no inflows or outflows. The concentration of methylarsenic compounds increases with the increase in arsenic concentration. Methylarsenic compounds were found in nearshore seawater areas and in association with the sargassum weed in the open oceans; shrimp, barnacles and fish in the sargassum weed ecosystem also showed small amounts of methylarsenic compounds. Air transport is a definite contamination source . Indoor areas, such as greenhouses, exhibited a marked evidence of alkylarsenic compounds in the air. (See also W77-01295) (Auen-Wisconsin)
W77-01302

THE NEED TO ESTABLISH HEAVY METAL STANDARDS ON THE BASIS OF DISSOLVED METALS,
Colorado Div. of Wildlife, Fort Collins. Research Center.
P. H. Davies.
In: International Joint Commission's Workshop Proceedings 'Toxicity to Biota of Metal Forms in Natural Water', October 7-8, 1975, Duluth, Minn. p. 93-126, April 1976. 4 fig., 14 tab., 16 ref.

Descriptors: *Heavy metals, *Toxicity, *Measurement, *Analytical techniques, *Standards, Solubility, Dialysis, Rainbow trout, Lead, Alkalinity, Hardness(Water), Lethal limit, Chemical precipitation, Cadmium, Polarographic analysis, Spectrophotometry, Silver iodide, Chelation.
Identifiers: *Application factor.

The toxicity of a particular metal can be determined irrespective of water quality when properly analyzed. This has been verified by long-term toxicity tests with lead and rainbow trout in hard and soft waters using atomic absorption for total lead and pulse polarographic analyses for dissolved lead. The experiments delineate the chemistry of lead, its toxicity to trout, and also demonstrate the failure of the application factor approach to predict safe heavy metal concentration in different types of water when chemical analyses are based on total concentrations of metals. When based on analyses of dissolved metals the utility of the application factor concept is verified. Its greatest potential use may be in predicting safe concentrations where synergistic and/or antagonistic mechanisms exist. The use of dialysis tubing to differentiate between dissolved and complexed forms of heavy metals is evaluated in investigations of cadmium toxicity to rainbow trout in hard and soft waters. The effects of filtration on analytical results, as a means for identifying 'dissolved' metal fractions is also discussed. A method demonstrates a long-term testing procedure of the 'insoluble compounds' within limits of their solubility constants by measuring the toxicity of silver iodide to rainbow trout in soft waters. (See also W77-01295) (Auen-Wisconsin)
W77-01305

POTENTIAL ROLES OF METAL-LIGANDS IN THE MARINE ENVIRONMENT,
Environmental Research Lab., Narragansett, R. I.
For primary bibliographic entry see Field 5B.
W77-01308

SYMPOSIUM ON STRUCTURE-ACTIVITY CORRELATIONS IN STUDIES OF TOXICITY AND BIOCONCENTRATION WITH AQUATIC ORGANISMS.
International Joint Commission-United States and Canada.
For primary bibliographic entry see Field 5C.
W77-01310

SURFACTANT STRUCTURE AND AQUATIC TOXICITY,
Monsanto Chemical Co., St. Louis, Mo.
R. A. Kimerle, R. D. Swisher, and R. M. Schroeder-Comotto.
In: International Joint Commission Symposium on 'Structure-Activity Correlations in Studies of Toxicity and Bioconcentration with Aquatic Organisms,' March 11-13, 1975, Canada Center for Inland Waters, Burlington, Ontario, p 25-55. 7 fig, 5 tab, 12 ref.

Descriptors: *Surfactants, *Toxicity, *Chemicals, *Molecular structure, *Solubility, Linear alkylate sulfonates, Lethal limit, Sorption, Daphnia, Minnows, Food chains, Osmosis, Pollutant identification.
Identifiers: Bioconcentration, Partition coefficient.

An attempt is described to determine the factors influencing measurement of the octanol/water partition coefficients of surfactants, and the relationship of surfactant partition coefficient to bioaccumulation and acute toxicity. The surfactants studied were series of LAS individual homologs with

alkyl chain lengths from 9 to 15 carbon atoms, representative commercial LAS blends, and a carboxylated LAS simulating a degradation metabolite. The partition coefficient for a given LAS sample may vary up to an order of magnitude or more, depending on LAS (1/c) concentration, solvent ratio, and water hardness. Correlation of the partition coefficient data with each of the foregoing toxicological properties indicated that intact LAS surfactants do behave in a more or less regular manner on Daphnia magna. It was not possible to correlate the partition coefficients with bioconcentration factors of specific organs and tissues of fathead minnows because LAS was readily metabolized and eliminated from the body. The model metabolite, sulfophylundecanoic acid disodium salt, showed a markedly lower partition coefficient and acute toxicity. The results suggest certain limitations in the applicability of partition coefficients to prediction of bioaccumulation. Although the partition coefficient measured for the original compound may govern its input rate into the organism, the clearance of metabolites will depend on their own partition coefficients, which may greatly differ. (See also W77-01310) (Auen-Wisconsin)
W77-01311

STRUCTURE-ACTIVITY RELATIONSHIPS IN FISH TOXICOLOGY,
Fisheries and Marine Service, St. Andrews (New Brunswick). Biological Station.
For primary bibliographic entry see Field 5C.
W77-01313

STRUCTURE-ACTIVITY RELATIONSHIPS APPLIED,
Minnesota Univ., Duluth. Dept. of Chemistry.
For primary bibliographic entry see Field 5C.
W77-01314

STATISTICAL PROPERTIES OF ENVIRONMENTAL DATA: CONSIDERATIONS FOR BIOACCUMULATION AND TOXICITY STUDIES OF POLLUTANTS,
Illinois State Environmental Protection Agency, Springfield.
For primary bibliographic entry see Field 5C.
W77-01316

A COMPARISON OF METHODS FOR THE ANALYSIS OF THE RELATIONSHIP BETWEEN CHEMICAL AND BIOLOGICAL PROPERTIES OF CHEMICALS,
Abbott Labs., North Chicago, Ill.
Y. C. Martin.
In: International Joint Commission Symposium on 'Structure-Activity Correlations in Studies of Toxicity and Bioconcentration with Aquatic Organisms,' March 11-13, 1975, Canada Center for Inland Waters, Burlington, Ontario, p. 143-150. 3 fig., 8 ref.

Descriptors: *Chemicals, *Toxicity, *Analytical techniques, Chemical properties, Biological properties, Mode of action, Graphical analysis, Regression analysis, Correlation analysis, Frequency analysis.
Identifiers: Pattern recognition, Discriminant analysis.

The features, strengths and weaknesses of graphical analysis, regression analysis, and pattern recognition/discriminant analysis are discussed in the application of biota toxicity as related to the molecular structure of chemicals. Graphical analysis is a powerful technique for the analysis of relationships between two or three variables. Not only does it summarize a relationship in a form easily understood by most scientists, but it can reveal causes for concern about the quality of a data set. Regression analysis is used to determine a least-squares fit of data to some equation. It is important to not evaluate too many possible variables as predictors; also ionizable compounds present a problem if potency is dependent on the concentration of an un-ionized chemical present. Linear regression analysis is most commonly used in quantitative-structure activity analysis. Non-linear regression analysis can be used to fit any equation, as illustrated by the application to drug absorption from the gastrointestinal tract for which the model involves a log P- dependent equilibrium and a rate determining step, also log-P dependent, out of the membrane into the blood. Pattern recognition and discriminant analysis are useful when the biological data is categorical and there are many associated chemical properties which determine the biological classification. (See also W77-01310) (Auen-Wisconsin)
W77-01319

TOXICITY INDEX FOR PERMITS,
National Field Investigations Center-Denver, Colo.
D. B. Seba.
In: International Joint Commission Symposium on 'Structure-Activity Correlations in Studies of Toxicity and Bioconcentration with Aquatic Organisms,' March 11-13, 1975, Canada Center for Inland Waters, Burlington, Ontario, p. 199-259. 7 fig., 2 tab., 148 ref.

Descriptors: *Toxicity, *Monitoring, *Standards, *Permits, Organic compounds, Molecular structure, Lethal limit, Water pollution control, Chemical properties, Effluents, Chemicals.
Identifiers: *Toxic units.

Water pollution control by the concept of 'toxic units' to be incorporated in an effluent permit system is considered. Because small differences in chemical structure can significantly influence the biologic effects of chemicals it is difficult to accurately forecast the toxicity of compounds to aquatic organisms by extrapolation from exposure data tests on alternative chemicals, it is proposed that a coefficient of relative potency can be derived to substantiate the toxic units concept. This approach to the problem of experimental prediction of adverse effects by the use of a reference substance for which toxicity is known for a particular structure is of possible use. Specific calculations, based on tolerance level median data, are presented for nitro, amine, nitrile, amide compounds, hetercycles, and phenols. A standard is proposed of 0.05 TU (toxic units) based on the tolerance level median 96-hr value or 96-hr exposure survival, and equations on how to measure that standard are shown. While the toxic units measurement contains assumptions and limitations thus its usage is not the ultimate monitoring device, it does place the burden on the discharger to maintain environmental quality control. (See also W77-01310). (Auen-Wisconsin).
W77-01321

CALCULATION OF PARTITION COEFFICIENTS USEFUL IN THE EVALUATION OF THE RELATIVE HAZARDS OF VARIOUS CHEMICALS IN THE ENVIRONMENT,
Pomona Coll. Claremont, Calif. Dept. of Chemistry.
For primary bibliographic entry see Field 5C.
W77-01322

RADIATION HAZARD FROM AMERICIUM-BERYLLIUM NEUTRON MOISTURE PROBES,
North Dakota State Univ., Fargo. Dept. of Soils.
For primary bibliographic entry see Field 2G.
W77-01324

SALT STORAGE AND RUNOFF IN URBAN WATERSHED,
Utah State Univ., Logan. Watershed Science Unit; and Utah State Univ., Logan. Dept. of Forestry and Outdoor Recreation.
For primary bibliographic entry see Field 5B.
W77-01336

THEORETICAL MODEL FOR THE FORMATION OF ION-PAIRS IN SEAWATER,
Rhode Island Univ., Kingston. Graduate School of Oceanography.
For primary bibliographic entry see Field 2K.
W77-01341

THE DETERMINATION OF CALCIUM- IN SEA WATER, CORALS AND CALCAREOUS ALGAE BY LIQUID SCINTILLATION COUNTING,
Cape Town Univ. (South Africa). Dept. of Biochemistry.
E. L. Bohm, and T. F. Goreau.
Trans. Roy. Soc. So. Afr., Vol 41 (1), p 25-31, (1974). 4 fig, 3 tab, 15 ref.

Descriptors: *Water analysis, *Sea water, *coral, Marine algae, Nitrates, Hydrogen bonding, Performance, *Pollutant identification, Calcium, Plant tissues.
Identifiers: Instagel, ETCS dioxane, *Liquid scintillation counting, South Africa, *Calcium-45, *Calcereous algae.

Calcium isolated from various fractions of corals and algae is converted into nitrate and dissolved in a water-ethyleneglycolmonoethylether-dioxane cocktail in the ratio of 1:2:20 using PPO and 1-dimethyl-POPOP as scintillators. 45Ca in sea water is counted directly after dilution of 1:10 with water. The carrier capacity of the system is 3 mmole Ca (NO3)2/23 ml (120 mg Ca). The counting efficiencies at minimum and maximum carrier concentration are 88,7% and 78,5% respectively. The scintillator solvent system is chemically stable and counts are highly reproducible. Instagel in the ratio of 10 ml to 1 ml aqueous solution gives counting efficiencies in the region of 80%. Sea water can be incorporated directly. Algal calcium is counted as the nitrate or the chloride. The carrier capacity of Instagel is higher and the counting efficiency is less affected by large concentrations of carrier and excess acid. (South Africa)
W77-01390

THE EUTROPHICATION LEVELS OF SOME SOUTH AFRICAN IMPOUNDMENTS. 1. RIETVLEI DAM,
National Inst. for Water Research, Pretoria (South Africa).
For primary bibliographic entry see Field 5C.
W77-01391

EUTROPHICATION LEVELS OF SOME SOUTH AFRICAN IMPOUNDMENTS. II. HARTBEESPOORT DAM,
National Inst. for Water Research, Pretoria (South Africa).
For primary bibliographic entry see Field 5C.
W77-01392

LIMNOLOGICAL DATA REPORT FOR THE MAINE DEPARTMENT OF ENVIRONMENTAL PROTECTION--U. S. GEOLOGICAL SURVEY COOPERATIVE LAKE STUDIES PROJECT,
Geological Survey, Augusta, Maine.
For primary bibliographic entry see Field 2H.
W77-01414

GROUND-WATER DATA FOR THE SANTA MARIA VALLEY, CALIFORNIA,
Geological Survey, Menlo Park, Calif.
For primary bibliographic entry see Field 4B.
W77-01415

CHEMICAL AND PHYSICAL CHARACTERISTICS OF WATER IN ESTUARIES OF TEXAS, OCTOBER 1971-SEPTEMBER 1973,
Geological Survey, Austin, Tex.
For primary bibliographic entry see Field 5B.
W77-01416

HYDROLOGIC DATA FOR URBAN STUDIES IN THE HOUSTON, TEXAS METROPOLITAN AREA, 1974,
Geological Survey, Austin, Tex.
For primary bibliographic entry see Field 7C.
W77-01419

LEAF ANALYSIS PROVES USEFUL IN INCREASING EFFICIENCY OF NITROGEN FERTILIZATION OF ORANGES AND REDUCING NITRATE POLLUTION POTENTIAL,
California Univ., Riverside. Dept. of Plant Sciences.
For primary bibliographic entry see Field 5G.
W77-01434

THE SPECTROMETRIC DETERMINATION OF MERCURY (AT 253,65 NM) IN NATURAL WATER - A BRIEF LITERATURE SURVEY,
National Physical Research Lab, Pretoria (South Africa).
R. J. Watling, and Helen R. Watling.
Water S A., Vol 1 (3), p 113-117, (1975). 1 fig, 3 tab, 33 ref.

Descriptors: *Pollutant identification, *Water analysis, Natural waters, Heavy metals, *Mercury, Fluorescence, *Spectroscopy, Trace elements, Analytical techniques, Sampling.
Identifiers: South Africa, Atomic absorption techniques.

With the growing interest in environmental pollution, the problems encountered in the storage and determination of mercury, present in water in ultra-trace concentrations, have received considerable attention. Atomic absorption, fluorescence and emission spectrometric methods of mercury analysis are reviewed, together with methods used to prevent mercury loss during sample storage. Reference is made to the use of an amalgamation technique as an alternative to solution storage. (South Africa)
W77-01442

THE EXPERIENCE WITH MONITORING WATER QUALITY IN WINDHOEK,
National Inst. for Water Research, Pretoria (South Africa).
For primary bibliographic entry see Field 5D.
W77-01457

ENERGY DISPERSIVE X-RAY ANALYSIS (EDAX) AS AN AUTOPSY TECHNIQUE FOR COPPER-CAUSED FISH MORTALITY,
National Inst. for Water Research, Pretoria (South Africa).
Deryl J. Barlow, and W. S. G. Morgan.
Water S A, Vol 1 (3), p 109-112 (1975). 3 fig, 1 tab, 12 ref.

Descriptors: *X-Ray analysis, *Fishkill, Metals, Toxicity, Copper, Electron microscopy, Lethal limit, *Pollutant identification, *Mortality, Absorption.
Identifiers: South Africa, Fish tissue analysis.

Energy dispersive analysis of X-rays (EDAS) can be used to indicate acute copper toxicity in fish. Copper was absorbed from lethal concentrations of copper sulphate by gill and liver tissue. Small quantities of copper were also found in opercular bones. Furthermore, as a cause of mortality, copper could be detected up to 48 hours after death. It is probable that the technique is not specific for copper toxicity but may be used as a rapid means of detecting a number of metal ion toxicants in dead fish. (South Africa)
W77-01460

VIRUSES IN WATER, (VIRUSSE IN WATER), (IN AFRIKAANS),
Pretoria Univ. (South Africa). Dept. of Microbiology.
O. W. Prozesky.
Geneeskunde, Vol 17(8), p 162-165, (1975). 19 ref.

Descriptors: *Viruses, Public health, *Pollutant identification, Water quality standards, Ultrafiltration, Nutrients, Water reuse, *Bacteriophages.
Identifiers: South Africa, Herpes virus, Rota viruses, Hepatitis.

Discussed are the changing water environment, the presence of viruses in water, the determination of such viruses, the effect of water purification processes on viruses, problem viruses and the virological standards of water purity. (South Africa)
W77-01481

POLLUTION, MAN, HIS ENVIRONMENT AND THE PHYSICIST, (BESOEDELING, DIE MENS, SY OMGEWING EN DIE FISIKUS),
For primary bibliographic entry see Field 5G.
W77-01482

METAL ENRICHMENT OF SEDIMENTS IN INLAND WATERS - THE HARTBEESPOORT DAM,
Pretoria Univ. (South Africa). Dept. of Chemistry.
G. T. W. Wittmann, and U. Forstner.
Water SA., Vol 1 (2), p 76-82, (1975). 7 fig, 2 tab, 7 ref.

Descriptors: Water pollution, *Sediments, *Heavy metals, Dams, Sewage effluents, Industrial wastes, Water pollution sources, Impoundments, Indicators, Lake sediments, *Pollutant identification.
Identifiers: South Africa, Hartbeespoort Dam, Jukskei River, Crocodile River, Transvaal.

Analyses of the sediment fraction <2 microns has been shown to be a reliable indicator of heavy metal pollution in the water environment. Based on this premise, research has been conducted to establish the presence of heavy metals in the sediments of the Hartbeespoort Dam near Pretoria which receives purified domestic and industrial effluents via the Jukskei and Crocodile Rivers. It was found that heavy metal enrichment in the Hartbeespoort Dam sediments could be divided into two groups: Enrichment of the western zone of the dam with iron, chromium, cobalt and nickel which could be ascribed to the basic geological formations associated with the feeder streams discharging into this section of the dam; and enrichment of the south-eastern zone of the dam with zinc, lead, mercury and cadmium which could be ascribed to pollution from domestic and industrial sources entering the dam via the Crocodile River. It is shown how it is possible to distinguish between heavy metal enrichment of sediments derived from geological sources and from man-made pollution respectively. (South Africa)
W77-01487

COMPILATION OF STATE DATA FOR EIGHT SELECTED TOXIC SUBSTANCES, VOL. III, ANNOTATED BIBLIOGRAPHY OF STATE DATA AND INFORMATION SOURCES,
Mitre Corp., McLean, Va.
E. Roberts.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-248 662, Price codes: A03 in paper copy, A01 in microfiche. Environmental Protection Agency, EPA 560/7-75-001-3, September 1975, 36 p., 1 tab., 12 ref.

Descriptors: *Bibliographies, *Basic data collections, *Arsenic compounds, *Beryllium, *Cadmium, *Chromium, *Lead, *Mercury, *Polychlorinated biphenyls, Information retrieval, On-site data collections, Information exchange, Monitoring, Public health, Toxicity, Pollutant identification.
Identifiers: *Arsenic, *Cyanide, *Toxic substances.

In June 1974, the Office of Toxic Substances, EPA, contracted with MITRE to collect and analyze toxic substances data in the U.S. In the next 14 months MITRE contacted agencies in 20 key states and collected and analyzed their monitoring data. This appendix is a cross-reference bibliography by state and by substance of every body of data and report collected from the state agencies in the course of the project. Substances of concern were arsenic, beryllium, cadmium, chromium, lead, mercury, polychlorinated biphenyls. (Katz)
W77-01494

ACUTE TOXICITY OF CHLORINE TO SELECTED ESTUARINE SPECIES,
Virginia Inst. of Marine Sciences, Gloucester Point.
For primary bibliographic entry see Field 5C.
W77-01508

THE DETERMINATION OF CADMIUM, LEAD, COPPER AND ZINC IN GROUND WATER, ESTUARINE WATER, SEWAGE AND SEWAGE EFFLUENT BY ANODIC STRIPPING VOLTAMMETRY,
Water Pollution Research Lab., Stevenage (England).
J. Gardiner, and M. J. Stiff.
Water Research Vol. 9, No. 5/6, p 517-523, May/June 1975. 1 fig, 8 tab, 22 ref.

Descriptors: Water quality, *Water quality control, *Trace elements, *Cadmium, *Lead, *Copper, Water pollution, *Zinc, *Pollutant identification, Analytical techniques.
Identifiers: Anodic stripping voltammetry.

Anodic stripping voltammetry (ASV) using the thin-film mercury electrode was shown to be a successful technique for the determination of total (free plus complexed) trace metal concentrations in various types of aqueous sample. The method developed involved the minimum of sample treatment and required only simple and inexpensive equipment. The practical limit of sensitivity was about 0.1 micro-g/l for cadmium, lead and copper. The determination of zinc was found to be complicated by the formation of an intermetallic compound with copper. Interference by other trace metals and by complexing agents was investigated. Photochemical oxidation for the decomposition of complexes of the metals with organic ligands in filtered sewage and sewage effluent was found to be successful, although the process is slower for cadmium than for the other metals. Good agreement with atomic absorption spectroscopy was obtained for all the types of aqueous sample investigated. Possible improvements of the ASV technique are discussed. (Skogerboe-Colo St)
W77-01518

A REVIEW OF THE POLLUTION ABATEMENT SITUATION IN INDUSTRY, MUNICIPALITIES AND GOVERNMENT,
Environmental Protection Agency, Washington, D. C. Office of Solid Waste Management Programs.
For primary bibliographic entry see Field 5G.
W77-01522

INVESTIGATION OF REMOTE SENSING TECHNIQUES FOR AGRICULTURAL FEEDLOT POLLUTION DETECTION,
South Dakota State Univ., Brookings. Remote Sensing Inst.
F. A. Schmer, D. W. Ryland, and F. A. Waltz.
Project Completion Report SDSU-RSI-72-14, April, 1973, 166 p. 37 fig, 9 tab, 14 ref.

Descriptors: *Research and development, *Remote sensing, *Feedlots, Water analysis, *Pollutant identification, Water quality, Farm wastes.
Identifiers: *Thermal imagery analysis.

This research effort was directed toward the application of remote sensing techniques to the detection and monitoring of pollution from cattle feeding operations. Five livestock feeding operations were selected for the study along the James River from Huron to Redfield, South Dakota. Thirteen aerial missions were flown from January 1, 1971 through June 30, 1972, providing aerial photography and thermal infrared data under various weather conditions. Water samples were collected during nine of the aerial flights at fourteen river locations. Water samples were collected a minimum of every three weeks on a regular schedule to allow independent analysis of the water quality data. Data analysis consisted of visual interpretation of aerial photography and statistical analysis of film densities and water quality parameters. Analysis of variance and linear regression techniques were also utilized. In addition an attempt was made to adjust the film densities for variations in incoming radiation. Results indicated that remote sensing techniques utilizing low and high altitude aircraft photography can be used to locate potential feedlot pollution sources. The statistical analysis showed good results for specific aerial missions but considerable variability was noted between aerial flights indicating that additional study is warranted. (East Central)
W77-01533

5B. Sources Of Pollution

FUTURE CHEMICAL COMPOSITION OF THE GREAT SALT LAKE BRINES,
Brigham Young Univ., Provo, Utah.
For primary bibliographic entry see Field 2H.
W77-01053

DISTRIBUTION AND SIGNIFICANCE OF FECAL INDICATOR ORGANISMS IN THE UPPER CHESAPEAKE BAY,
Maryland Univ., College Park. Dept. of Microbiology.
For primary bibliographic entry see Field 5C.
W77-01061

DEEP WELL WASTES MAY BE WATER HAZARDS.
Science News, Vol 109, p 295, May 8, 1976. 1 p.

Descriptors: *Chemical wastes, *Underground waste disposal, *Injection wells, *Groundwater resources, *Underground storage, Water supply, Seepage, Sewage disposal, Sewage treatment, Wells, Underground streams, Aquifers, Subsurface waters, Chemicals, Injection, Water resources.

The common notion that well injection liquids remain stable has come under attack from a recent study done on wells in North Carolina. Whereas oil companies have been pumping brine into underground formations to force the oil to the surface without ill effects, there seem to be dangers involved in the injection of chemical wastes, and especially of acetic wastes. Scientists found from observation of 14 wells that the acids were quite unstable, that they caused clay minerals and iron oxides to dissolve from the acquifers and move through underground formations, and that they caused re-precipitation forming a gel-like material which plugged the pores of the acquifer. The team doing the study recommended that initial testing be done on the chemicals before injection. Furthermore, where necessary, there should be pretreatment so that groundwater movement would not pollute drinking water supplies. (Frank-Florida)
W77-01083

OF SLIME AND THE RIVER,
F. Graham.
Audobon, Vol 77, p 9-15, March 1975. 7 p, 1 map, 3 photo.

Descriptors: *Federal Water Pollution Control Act, Rivers, *River regulation, *Pulp wastes, *Pulp and paper industry, Water pollution, Industrial wastes, Wastes, Water pollution sources, Chemical wastes, Lumbering, Wood wastes, Forests, Bleaching wastes, Legal aspects, Water pollution treatment, Maine, New Hampshire.
Identifiers: *FWPCA Amendments of 1972, *Androscoggin River(NH-ME).

The Androscoggin River flows south through New Hampshire into Maine. The river begins in a sparkling pure condition at Umbagog Lake and flows some 90 miles before it runs by paper and pulp mills. Berln, New Hampshire, is the site of a pulp mill that puts 3,500 gallons of waste sulfite liquor into the water for each ton of pulp produced. Berln is also the site of 45 public sewers discharging untreated wastes into the Androscoggin while another twenty empty into a tributary, the Dead River. The river's future rests in part with how well the Federal Water Pollution Control Act amendments of 1972 withstand the current environmental slowdown. An extension has just been granted to the Brown Company Pulp Mill of Berlin that will permit unimpeded pollution for at least another year. Pollution treatment planta are presently being built by industry and town alike; however, it maybe 'too little, too late'. It is hoped that the possible inclusion of large stretches of the river under the protection of the National Wild and Scenic Rivers System might bring substantial improvement. (Frank-Florida)
W77-01084

TOTAL MINERAL DISSOLVED TRANSPORT BY WORLD MAJOR RIVERS,
Paris Univ., Orsay (France). Ecol Normale Superieure; and Paris Univ. (France). Laboratoire de Geologie.
M. Meybeck.
Hydrological Sciences Bulletin, Vol. 21, No. 2, p 265-284, June 1976. 3 fig, 3 tab, 77 ref.

Descriptors: *Rivers, *Ion transport, Mineral water, Hydrology, Water quality, Discharge, Runoff, Oceans, Equations, Topography, Climates, Path of pollutants.
Identifiers: *Mineral transport, *Dissolved transport, Ion content, Specific discharge, Solid transport data, Water mineralization, Ionic ratios, Hydrologic features, Water quality data.

World variations of dissolved transport (Td) and major ion content with runoff and solid transport (Ts) were examined on the basis of 40 of the world's biggest rivers. For each river, estimates of each of the above factors were given, and two subsamples were considered according to the size of the rivers. For each subsample it was found that major ion content was inversely related to runoff, and dissolved transport was directly related to runoff and to solid transport. The ratio Ts/Td was highly variable, but it generally increased when solid transport increased. Climate dominated major ion content variation, and relief dominated dissolved transport variation. Wide scatterings of major ion content and dissolved transport were due to the other factor - relief or climate respectively. On a world scale, relief was the main factor controlling variations of dissolved transport with solid transport. The direct relationship between dissolved transport and solid transport confirmed the work of Alekin and Brazhnikova in the USSR, while the inverse relationship found by Judson and Ritter in the conterminous United States seemed to be a minor trend due to the influence of climate surpassing relief. It was concluded that if chemical transport is a major factor on the earth's surface, the solid material carried by the rivers to the ocean as a whole is five times more than the dissolved transport on the basis of these 40 rivers. (Roberts-ISWS)
W77-01135

PERCOLATION OF SURFACE-APPLIED WATER IN THE FIELD,
Kentucky Agricultural Experimental Station, Lexington.
For primary bibliographic entry see Field 2G.
W77-01137

MODELING OF UNSTEADY TEMPERATURE DISTRIBUTION IN RIVERS WITH THERMAL DISCHARGES,
Purdue Univ. Lafayette, Ind. School of Mechanical Engineering. and Purdue Univ., Lafayette, Ind. Heat Transfer Lab.
R. G. Hills, and R. Viskanta.
Water Resources Research, Vol. 12, No. 4, p 712-722, August 1976. 20 fig, 29 ref.

Descriptors: *Heated water, *Thermal stratification, Analytical techniques, *Turbulent flow, *Mixing, Water temperature, Channel flow, Heat transfer, Radiation, Numerical analysis, Equations, Rivers, *Thermal pollution.
Identifiers: *Unsteady temperature distribution, Temperature distribution, Thermal discharge.

Unsteady temperature distribution was analyzed in a wide channel simulating a river. The effects of thermal discharges, meteorological conditions, solar and atmospheric radiation, and channel parameters on the thermal structure of a river were analyzed and discussed by utilizing an analytical model for the unsteady three-dimensional temperature distribution in the far field of a thermally stratified channel. The conservation of energy equation for turbulent flow was solved numerically with an alternating direction implicit finite difference scheme. The effects of thermal start-up, discharge temperature level, discharge location, river flow velocity, and other factors were investigated. The results showed that the greater the temperature excess above the ambient at the discharge, the greater downstream distance is needed to reach a fully mixed condition because of the suppressive effect of stratification on the turbulent mixing. The greater surface temperatures associated with thermally stratified flow resulted in increased heat dissipation and water evaporation from the surface. (Singh-ISWS)
W77-01144

NITRATE AND CHLORIDE POLLUTION OF AQUIFERS: A REGIONAL STUDY WITH THE AID OF A SINGLE-CELL MODEL,
Tahal-Water Planning for Israel, Ltd. Tel-Aviv.
A. Mercado.
Water Resources Research, Vol. 12, No. 4, p 731-747, August 1976. 15 fig, 6 tab, 7 ref.

Descriptors: *Nitrates, *Chlorides, *Water pollution, *Aquifers, *Mathematical models, Water pollution sources, Hydrologic properties, Zone of aeration, Water wells, Water table, Biochemistry, Groundwater, Tracers, Forecasting, Monte Carlo method, Probability, Statistical models, Tertiary treatment, Groundwater recharge, Equations.
Identifiers: *Israel, Single-cell model.

A single-cell model was used to study the regional chloride and nitrate pollution patterns in part of the coastal aquifer of Israel. The model integrated pollution sources on the land surface, hydrologic parameters of the aquifer and the unsaturated zone, and variations of chloride and nitrate concentration distribution in pumping wells. Complicated hydrologic and biochemical processes in the unsaturated zone were simplified and represented by two basic parameters: (1) transit time from land surface to the aquifer, and (2) nitrogen losses in the soil. It was shown that linear relationships exist between nitrogen quantities released on the surface and the quantities reaching the water table. The calibration of the model enabled its use for prediction purposes. The Monte Carlo technique was introduced to determine the range of predicted average groundwater concentrations as a function of time. The forecasts

presented call for urgent protection measures in order to meet drinking water standards for maximum nitrate concentrations. Thirteen alternative protection measures were examined and then compared to predictions based on present nitrogen loads and hydrologic regime. The exchange relationships between these measures were derived, and it was suggested that they can be used later for evaluating economic criteria for protecting groundwater quality. (Visocky-ISWS)
W77-01145

AN ANALYSIS OF SALINITY VARIATIONS WITHIN GREAT SOUTH BAY, NEW YORK,
Environmental Defense Fund, East Setauket, N. Y.
For primary bibliographic entry see Field 2L.
W77-01149

MODELING PHYTOPLANKTON BLOOMS IN A STRATIFIED EMBAYMENT,
Utah Water Research Lab., Logan.
For primary bibliographic entry see Field 5C.
W77-01163

NON-POINT SOURCE CONTRIBUTIONS TO WATER QUALITY PROBLEMS,
Waterloo Univ. (Ontario). Dept. of Civil Engineering.
E. A. McBean, and J. E. Gorrie.
In: Proceedings of the 10th Canadian Symposium 1975, Water Pollution Research Canada, p 142-150. 12 fig, 9 tab, 6 ref.

Descriptors: *Water pollution control, *Nitrogen, *Phosphorus, *Regression analysis, *Water quality, Drainage area, River basins, Sampling, Flow, Systems analysis, Path of pollutants.
Identifiers: *St. John River basin(New Brunswick, Canada), Mass flux, Instream flow, Multiple regression technique, *Non-point pollution sources.

Non-point source contributions of nitrogen and phosphorus are examined. A useful relation between nitrogen and phosphorus mass flux and instream flow is demonstrated to occur at a number of sampling locations situated on the Saint John River Basin. As well, through a multiple regression study, evidence is presented that argues that the variations in non-point source loadings observed from location to location are explainable in terms of the variations of relatively easily-measured parameters that describe the contributing areas. (Bell-Cornell)
W77-01173

THE MODELLING AND CONTROL OF POLLUTION IN A RIVER SYSTEM,
Cambridge Univ. (England). Dept. of Engineering.
P. Young, B. Beck, and M. Singh.
Journal of Hydrology, Vol. 28, No. 2/4, p 289-316, February 1976. (Published in Amsterdam) 7 fig, 24 ref.

Descriptors: *Water pollution control, *Mathematical models, *River systems, *Water quality, Dissolved oxygen, Biochemical oxygen demand, Effluents, Sewage, Design, Simulation analysis, Optimization, Equations, Systems analysis, Path of pollutants.

A river which is being used either as a source for potable supply or for recreation requires an adequate and, if possible, an automatic control system for maintaining pollution levels within reasonable bounds consistent both with the needs of the community and the requirements for maintaining a satisfactory ecological balance. This paper makes a preliminary examination of the design of such a system by considering the dynamic modeling and control of dissolved oxygen (DO) and biochemical oxygen demand (BOD) in a river system. This includes a discussion on the derivation and verification of simple DO-BOD models for a typical river, as well as initial thoughts on the operational control of sewage effluent discharges in order to maintain specified levels of dissolved oxygen in single and multiple reach river systems. (Bell-Cornell)
W77-01175

WATER QUALITY CONTROL UNDER UNCERTAINTY: OPTIMAL STOPPING RULES FOR SAMPLING,
Arizona Univ., Tucson. Dept. of Systems and Industrial Engineering.
For primary bibliographic entry see Field 5G.
W77-01176

RADIONUCLIDES IN CHESAPEAKE BAY SEDIMENTS,
National Aeronautics and Space Administration, Greenbelt, Md. Goddard Space Flight Center.
For primary bibliographic entry see Field 2L.
W77-01188

WILDLIFE AND OIL SHALE, A PROBLEM ANALYSIS AND RESEARCH PROGRAM. VOLUME II, APPENDIX.
Thorne Ecological Inst., Boulder, Colo.
For primary bibliographic entry see Field 5C.
W77-01236

INVESTIGATION OF SELECTED POTENTIAL ENVIRONMENTAL CONTAMINANTS, CHLORINATED PARAFFINS,
Syracuse Univ. Research Corp., N.Y.
For primary bibliographic entry see Field 5C.
W77-01238

MINERAL REQUIREMENTS IN FISH--II. MAGNESIUM REQUIREMENT OF CARP,
Tokyo Univ. of Fisheries, 4, (Japan). Lab. of Fish Nutrition.
For primary bibliographic entry see Field 5C.
W77-01239

SPATIAL DISPERSION OF AN ESTUARINE BENTHIC FAUNAL COMMUNITY,
Swedish Water and Air Pollution Research Lab., Goteborg.
R. Rosenberg.
Journal of Experimental Marine Biology and Ecology, Vol. 15, p. 69-80, 1974. 3 fig., 4 tab., 15 ref.

Descriptors: *Biological communities, *Benthic fauna, *Benthos, *Biomass, *Spatial distribution, Population, Aquatic populations, Methodology, Distribution, Sampling, Bottom sampling, Crustaceans, Sediments, Water pollution effects, Environmental effects, *Estuarine environment.

By means of a box-sampler 20 moderately undisturbed sediment samples were obtained and subsampled. The fauna in the upper 0-5 cm of the sediments was compared to that in the 5-10 cm layer. Almost all species collected in both strata were found in the upper 0-5 cm about 64% of the individuals and 74% of the biomass were restricted to this upper layer. A sample area of 0.5 square meter (depth 0-10 cm) was found to be sufficient to make a quantitative evaluation of the benthic community. The horizontal dispersion of the macrobenthic community was studied using the variance/mean ratio and its dependence on sample size is discussed. The abundant species occurred in patches larger than 0.06 square meter and were correlated with aggregation. (Katz)
W77-01246

ORGANIC MATTER IN ATMOSPHERIC PRECIPITATION IN THE VORONEZH REGION, (IN RUSSIAN),
Voronezhskii Lesotekhnicheskii Institut (USSR).
I. M. Rozinoer, A. P. Saprykina, and S. M. Poroiskaya.
Gidrobiol Zh. 9(2), p 100-104, 1973.

Descriptors: *Rain water, *Organic matter, *Measurement, Carbon compounds, Nitrogen, Snow, Acids, Amino acids microorganisms, Precipitation(Atmospheric).
Identifiers: Esters, Fatty acids, Macrophytes, USSR, *Voronezh region(USSR).

Organic matter in 10 samples of rain water and 12 of water from snow obtained near the Voronezh River in Voronezh, USSR, were analyzed in association with the filling of the Voronezh Reservoir by flood waters. The total content of organic matter determined by permanganate oxidizability and nonvolatile C compounds was lower in summer and spring rain water and higher in snow than in river water during the same period. The amount of N was 2-3 times higher in precipitated water; this was evidently due to anthropogenic factors. All 3 indices were higher in summer-fall rain than in snow. Volatile fatty acids occurred in all the samples, varying from 4.8-7.4 micro/g-equivalent/l for rain and 1.2-23.8 micro/g-equivalent/l for snow. The higher amount of volatile organic acids in river water was more pronounced in summer than in winter. In most samples no free amino acids were found. Increases in the content of amino acids in hydrolysates was linked to the breakdown of protein by microorganisms and macrophytes. Complex esters were found in the majority of rain water samples and in almost all the snow samples. Tests made 18 km from the city in an attempt to escape the effects of pollution gave the same results.--Copyright 1975, Biological Abstracts, Inc.
W77-01249

PCB CONTENTS IN MARINE ANIMALS COLLECTED IN THE EAST CHINA SEA, (IN JAPANESE),
Hokkaido Univ., Sapporo (Japan). Lab. of Food Hygiene.
For primary bibliographic entry see Field 5C.
W77-01255

THE ENVIRONMENTAL CHEMISTRY OF COPPER (II) IN AQUATIC SYSTEMS,
Australian Atomic Energy Commission Research Establishment, Lucas Heights, Div. of Chemical Technology.
R. N. Sylva.
Water Research, Vol. 10, p. 789-792, 1976. 2 tab., 3 fig., 8 ref.

Descriptors: *Water pollution sources, *Copper, *Metals, *Toxicity, *Adsorption, Chemistry, *Water chemistry, *Aquatic environment, Laboratory tests, Analytical techniques, Hydrogen ion concentration, Hydrolysis.
Identifiers: *Copper ions.

The speciation of copper (II) in fresh water has been examined by considering inorganic and organic complexation and adsorption and precipitation processes. It is concluded that in most aquatic systems these processes are capable of reducing free copper levels to very low values even in the presence of high levels of total copper. (Katz)
W77-01257

MATHEMATICAL ANALYSIS OF THE CHEMICAL SYSTEM 'CYANIDE-HEAVY METALS' IN THE WATER-DETERMINATION OF COMPONENTS AND TOXICITY OF THE SYSTEM-I, THE THEORETICAL SOLUTION,
State Research Inst. of the Textile Industry, Brno (Czechoslovakia) Center for Research and Appplication Ionized Radiation.
J. Blaha.
Water Research, Vol. 10, p. 815-819, 1976. 10 ref.

Descriptors: *Heavy metals, *Toxicity, *Water chemistry, Mathematical studies, *Analytical techniques, *Mathematical models, *Toxins, Hydrogen ion concentration, Water quality.
Identifiers: *Cyanide-heavy metals, *Cyanide complexes.

A mathematical analysis of the chemical system 'cyanide-heavy metals' in water is described. It allows to determine the type, number, and concentration of the systems components to be computed. This mathematical analysis replaces chemical analysis, both quantitative and qualitative. The former is replaced by mathematical testing of the chemical properties of the system; the later is replaced by solution of the equations for calculating the components concentrations in the system. (See also W77-01260) (Katz)
W77-01259

MATHEMATICAL ANALYSIS OF THE CHEMICAL SYSTEM 'CYANIDE-HEAVY METALS' IN WATER-DETERMINATION OF COMPONENTS AND TOXICITY OF THE SYSTEM-II, SOLUTION BY COMPUTER,
State Textile Research Inst., Brno (Czechoslovakia). Center for Research and Application Ionized Radiation.
J. Blaha.
Water Research, Vol. 10, p. 821-828, 1976. 2 tab., 7 ref.

Descriptors: *Analytical techniques, *Toxicity, *Computer programs, *Water quality, *Mathematical models, Heavy metals, Computers, Hydrogen ion concentration, Chemical properties, Water properties.
Identifiers: *Cyanide-heavy metal complexes.

This constitutes Part Two of a paper dealing with the chemical system 'cyanide-heavy metals' in water. A complete program in the programming language PL/I has been worked out and is presented; it is applicable for practical IBM computer calculations of toxicity of the chemical system. Proposition of a general analytical scheme is advanced. (See also W77-01259) (Katz)
W77-01260

THE ACCUMULATION OF PCB AS A FUNCTION OF GROWTH IN JAPANESE ANCHOVY CAUGHT IN OSAKA BAY, (IN JAPANESE),
Osaka Prefectural Fisheries Experimental Station, (Japan).
For primary bibliographic entry see Field 5C.
W77-01265

SOIL NITRATE LOSS DURING IRRIGATION: ENHANCEMENT BY PLANT ROOTS,
California Univ., Berkeley, Coll. of Natural Resources.
For primary bibliographic entry see Field 3F.
W77-01268

LOWER GREEN BAY. AN EVALUATION OF EXISTING AND HISTORICAL CONDITIONS,
Wisconsin Dept. of Natural Resources, Madison.
For primary bibliographic entry see Field 5C.
W77-01287

WORKSHOP ON TOXICITY TO BIOTA OF METAL FORMS IN NATURAL WATER.
International Joint Commission-United States and Canada.
For primary bibliographic entry see Field 5C.
W77-01295

COMPLEXATION OF METALS IN NATURAL WATER,
Canada Centre for Inland Waters, Burlington (Ontario).
For primary bibliographic entry see Field 5C.
W77-01296

DISTRIBUTION AND BIOACCUMULATION OF MERCURY IN BIOTIC AND ABIOTIC COMPARTMENTS OF A CONTAMINATED RIVER-RESERVOIR SYSTEM,
Oak Ridge National Lab., Tenn.
For primary bibliographic entry see Field 5C.
W77-01297

ZINC SPECIATION AND TOXICITY TO FISHES,
Montana State Univ., Bozeman. Dept. of Chemistry.
For primary bibliographic entry see Field 5C.
W77-01298

STRUCTURE-ACTIVITY RELATIONS AND THE TOXICITY OF TRACE ELEMENTS TO AQUATIC BIOTA,
Atlantic Biological Station, St. Andrews (New Brunswick).
For primary bibliographic entry see Field 5C.
W77-01299

METAL SPECIATION IN AQUATIC ENVIRONMENTS,
Illinois Inst. of Tech., Chicago. Dept. of Environmental Engineering.
For primary bibliographic entry see Field 5C.
W77-01300

PHARMACOKINETIC APPROACHES TO THE EVALUATION OF METHYLMERCURY IN FISH,
Michigan Univ., Ann Arbor. Public Health Toxicology Program.
For primary bibliographic entry see Field 5C.
W77-01301

MOLECULAR FORMS OF ARSENIC IN THE ENVIRONMENT,
University of South Florida, Tampa. Dept. of Chemistry.
For primary bibliographic entry see Field 5A.
W77-01302

THE MULTIPLE TOXICITY OF CERTAIN HEAVY METALS: ADDITIVE ACTIONS AND INTERACTIONS,
Concordia Univ., Montreal (Quebec). Dept. of Biological Sciences.
For primary bibliographic entry see Field 5C.
W77-01303

TOXICITY RELATIONSHIPS TO COPPER FORMS IN NATURAL WATERS,
Environmental Research Lab., Duluth, Minn.
For primary bibliographic entry see Field 5C.
W77-01304

THE NEED TO ESTABLISH HEAVY METAL STANDARDS ON THE BASIS OF DISSOLVED METALS,
Colorado Div. of Wildlife, Fort Collins. Research Center.
For primary bibliographic entry see Field 5A.
W77-01305

ASPECTS OF HEAVY METALS TOXICITY IN FRESH WATERS,
Water Pollution Research Centre Stevenage (England).
For primary bibliographic entry see Field 5C.
W77-01306

COPPER TOXICITY TO PHYTOPLANKTON, AS AFFECTED BY ORGANIC LIGANDS, OTHER CATIONS AND INHERENT TOLERANCE OF ALGAE TO COPPER,
Toronto Univ. (Ontario). Inst. for Environmental Studies and Engineering.
For primary bibliographic entry see Field 5C.
W77-01307

POTENTIAL ROLES OF METAL-LIGANDS IN THE MARINE ENVIRONMENT,
Environmental Research Lab., Narragansett, R. I.
E. W. Davey.
In: International Joint Commission's Workshop Proceedings 'Toxicity to Biota of Metal Forms in Natural Water', October 7-8, 1975, Duluth, Minn. p. 197-209, April 1976. 5 fig., 1 tab., 14 ref.

Descriptors: *Heavy metals, *Toxicity, *Sea water, *Analytical techniques, *Copper, Bioassay, Computer models, Measurement, Chelation, Organic matter, Marine algae, Detergents.
Identifiers: Computer model REDEQL II, Ligands, Thalassiosira pseudonana.

A bioassay technique that measures 0.003 M concentrations of EDTA in metal-ligand interactions, using the growth response of the oceanic diatom Thalassiosira pseudonana in artificial seawater, is described. At the equivalence point (point of maximum inflection of the signoid curve) the moles of copper added are equal to the moles of EDTA present in solution. The T. pseudonana copper bioassay could also be utilized as an endpoint detector for the quantitative measurement of copper binding capacity of seawater, and to quantitate natural organic chelators which might occur by using the methodology described. This bioassay is also applicable to semi-quantitation of the presence of natural or added synthetic chelators in the marine environment. The addition of synthetic chelators to oceanic waters could have three immediate ramifications. First, metals may become solubilized and transported from regions of high concentration to uncontaminated areas. Second, over-chelation of trace metals necessary for the growth of marine organisms, especially phytoplankton, is possible. Third, increased pathogenicity of marine waters could occur by the reduction of the 'natural' metal toxicity of seawater. Another potential predictive tool of metal-ligand interactions in seawater is the chemical computer model REDEQUL II, that includes equilibrium reactions between the major anions and cations in seawater. (See also W77-01295) (Auen-Wisconsin)
W77-01308

EFFECTS OF ORGANIC POLLUTANTS ON COPPER TOXICITY TO FISH,
Michigan Univ., Ann Arbor. Dept. of Environmental and Industrial Health.
For primary bibliographic entry see Field 5C.
W77-01309

SYMPOSIUM ON STRUCTURE-ACTIVITY CORRELATIONS IN STUDIES OF TOXICITY AND BIOCONCENTRATION WITH AQUATIC ORGANISMS.
International Joint Commission-United States and Canada.
For primary bibliographic entry see Field 5C.
W77-01310

SURFACTANT STRUCTURE AND AQUATIC TOXICITY,
Monsanto Chemical Co., St. Louis, Mo.
For primary bibliographic entry see Field 5A.
W77-01311

PREDICTING A BIOCONCENTRATION POTENTIAL OF ORGANIC CHEMICALS IN FISH FROM PARTITION COEFFICIENTS,
Dow Chemical Co., Midland, Mich.
For primary bibliographic entry see Field 5C.
W77-01312

STRUCTURE-ACTIVITY RELATIONSHIPS IN FISH TOXICOLOGY,
Fisheries and Marine Service, St. Andrews (New Brunswick). Biological Station.
For primary bibliographic entry see Field 5C.
W77-01313

STRUCTURE-ACTIVITY RELATIONSHIPS APPLIED,
Minnesota Univ., Duluth. Dept. of Chemistry.
For primary bibliographic entry see Field 5C.
W77-01314

STRUCTURE-ACTIVITY RELATIONSHIPS OF DDT ANALOGS IN A NON-TARGET ORGANISM. LETHAL AND SUBLETHAL EFFECTS OF BROOK TROUT FINGERLINGS,
Carleton Univ., Ottawa (Ontario). Dept. of Biology.
For primary bibliographic entry see Field 5C.
W77-01315

MATHEMATICAL MODELS TO DESCRIBE THE TIME/SPACE DISTRIBUTION OF CHEMICALS IN A WATER SYSTEM,
Dow Chemical U.S.A., Midland, Mich. Functional Products and Systems.
W. B. Neely.
In: International Joint Commission Symposium on 'Structure-Activity Correlations in Studies of Toxicity and Bioconcentration with Aquatic Organisms,' March 11-13, 1975, Canada Center for Inland Waters, Burlington, Ontario, p. 261-269. 1 fig., 4 ref.

Descriptors: *Mathematical models, *Chemicals, Design, Temporal distribution, Spatial distribution, Toxicity, Pollutant identification, Food chains.
Identifiers: *Bioconcentration.

The chemical industry's use of mathematical models is to help the decision maker to interpret data, guide ongoing data collection efforts, and make predictions on future events. Another function of their models is to approximate an ecosystem so that perturbations by new inputs can be depicted and resulting consequences simulated. The underlying principle of a simulation is the decision as to what questions are asked and what information needs to be generated. Compartment models are generally used by the industry to resolve the problems of predicting the time/space distribution of chemicals and the relations that exist between the ecosystem components. The primary steps in model building consist of : (1) Explanation of bioconcentration, with pollution coefficients following as a natural extension; (2) distribution of a chemical in the ecosystem; and (3) space/time distribution posing the questions of how toxic is the material; what will the concentration profile look like downstream; where the nearest drinking water intake is; and how long the wave reaches that point. This discussion was illustrated by slides. (See also W77-01310) (Auen-Wisconsin)
W77-01317

AN APPROACH TO THE STUDY OF MULTIPLE TOXICITY,
Sir George Williams Univ., Montreal (Quebec). Dept. of Biological Sciences.
For primary bibliographic entry see Field 5C.
W77-01318

BIOCONCENTRATION OF 14C-PESTICIDES BY BLUEGILL SUNFISH DURING CONTINUOUS AQUEOUS EXPOSURE,
Bionomics, Inc., Wareham, Mass.
For primary bibliographic entry see Field 5C.
W77-01320

CALCULATION OF PARTITION COEFFICIENTS USEFUL IN THE EVALUATION OF THE RELATIVE HAZARDS OF VARIOUS CHEMICALS IN THE ENVIRONMENT,
Pomona Coll. Claremont, Calif. Dept. of Chemistry.
For primary bibliographic entry see Field 5C.
W77-01322

SALT STORAGE AND RUNOFF IN URBAN WATERSHED,
Utah State Univ., Logan. Watershed Science Unit; and Utah State Univ., Logan. Dept. of Forestry and Outdoor Recreation.
R. H. Hawkins.
Journal of the Environmental Engineering Division, American Society of Civil Engineers, Vol. 102, No. EE4, Proceedings Paper 12292, p 737-743, August 1976. 3 fig, 3 tab, 9 ref, append.

Descriptors: *Chlorides, *Deicers, *Urban runoff, *Salts, *New York, Water quality, Low flow, Groundwater, Watersheds(Basins), Water pollution sources.
Identifiers: *Syracuse(NY), *Meadowbrook Watershed(NY).

Street salting studies in the Meadowbrook Watershed, Syracuse, New York were described. Over a 3 yr study period, 81.5% of the salts applied left the watershed in runoff waters. Considering the suburban nature of the basin, this was in consonance with results found elsewhere. Chloride concentrations in the low flow months of April-October were found to increase with time, suggesting that salt is accumulating in the local groundwater, which is a source of supply for these low flows. (Lardner-ISWS)
W77-01336

ENVIRONMENT POLLUTION BY ORGANOPHOSPHORUS COMPOUNDS, (IN RUSSIAN),
Vsesoyuznyi Nauchno-Issledovatelskii Institut Gigieni I Toksikologii Pestitsidov, Kiev (USSR).
E. I. Spynu, L. N. Ivanova, and A. V. Bolotnyi.
Gig Sanit. 38(10), p 75-79, 1973.

Descriptors: Pesticides, Environment, Pollutants, *Organic pesticides, *Organophosphorus pesticides, *Reviews, *Water pollution, *Air pollution, *Soil contamination, Path of pollutants.

A review of the literature showed that the behavior of organophosphorus pesticides in the environment depends on many factors. The migration of these pesticides with the soil solution can lead to the formation of a pollution chain: soil-plant and soil-water. Four groups of factors determining the level and persistence of pesticides in individual media and processes of their migration are distinguished: the physicochemical properties of the pesticides, characteristics of the medium (soil, plant, water, air), conditions of applying the pesticides, and climatic and geographic characteristics of individual regions where the pesticides are used.--Copyright 1975, Biological Abstracts, Inc.
W77-01352

CHEMICAL AND PHYSICAL CHARACTERISTICS OF WATER IN ESTUARIES OF TEXAS, OCTOBER 1971-SEPTEMBER 1973,
Geological Survey, Austin, Tex.
K. W. Ratzlaff.
Texas Water Development Board Report 208, June 1976. 348 p, 13 fig, 10 tab, 6 ref.

Descriptors: *Water quality, *Path of pollutants, *Estuaries, *Gulf of Mexico, *Texas, Basic data collections, Water analysis, Chemical analysis, Sampling, Physicochemical properties, Biological properties, Nutrients, Heavy metals, Tidal effects.

This report, fifth in an annual series of basic-data reports, presents data collected during water years 1972 and 1973 in the estuaries of Texas. The objectives of the investigation are to define: (1) The occurrence, source, and distribution of nutrients; (2) the physical, organic, and inorganic water-quality constituents and their areal distribution and time variations; (3) the chemical and physical characteristics of Gulf water that enters the estuaries; (4) the occurrence, quality, quantity, and dispersion of drainage entering the estuarine systems; and (5) the current patterns, directions, and rates of water movement. Approximately 400 data-collection sites were visited yearly during water years 1972 and 1973. (Woodard-USGS)
W77-01416

THE RELATIONSHIP BETWEEN NITRATE CONCENTRATIONS IN THE SOUTHERN APPALACHIAN MOUNTAIN STREAMS AND TERRESTRIAL NITRIFIERS,
Forest Service (USDA), Franklin, N.C. Coweeta Hydrologic Lab.
R. L. Todd, W. T. Swank, J. E. Douglass, P. C. Kerr, and D. L. Brockway.
Agro-Ecosystems, Vol 2, p 127-132, 1975. 3 fig, 1 tab, 11 ref.

Descriptors: *Nitrates, *Nitrification, *Nitrogen fixing bacteria, Streamflow, *Appalachian Mountain Region, Southeast US, Streams, Nitrogen, Watersheds(Basins), Path of pollutants.
Identifiers: Southern Appalachians region, Nitrate-nitrogen.

The nitrate content of stream water and the nitrifying bacterial population of the terrestrial horizon were measured in three southern Appalachian watersheds over a 22-month period. The watersheds studied were a fescue grass catchment, a 15-year old white pine plantation, and a mature undisturbed hardwood forest. Monthly averages of nitrate-nitrogen in stream water from the three watersheds were 730, 190, and 3 ppb respectively; the respective nitrifying populations averaged 16,000, 175 and 22 per gram of dry weight for each 40 cm soil profile. These populations were concentrated in the upper 10 cm of the profile (grass = 98%, white pine = 90%, and hardwood = 88%). A correlation is evident between the number of nitrifying bacteria in the soil from gaged watersheds and the NO3 content of the streams. Nitrifying activity appears to be dependent on vegetation type and successional stage. (Forest Service)
W77-01423

METHANE, CARBON DIOXIDE, AND DISSOLVED SULFATE FROM INTERSTITIAL WATER OF COASTAL MARSH SEDIMENTS,
Louisiana State Univ., Baton Rouge. Coastal Studies Inst.
T. Whelan.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A005 795, Price codes: A02 in paper copy, A01 in microfiche. Estuarine and Coastal Marine Science, (1974) 2, p. 407-415, 2 tab., 4 fig., 16 ref.

Descriptors: *Carbon cycle, *Carbon dioxide, Gases, *Sediments, *Methane, *Louisiana, *Coastal marshes, Tidal marshes, Muck soils, Swamp, Chlorides, Sulfates, Salinity, *Methane bacteria.
Identifiers: Marsh sediment, South Louisiana.

The depth distributions of dissolved methane, total carbon dioxide, chloride, and sulfate in interstitial waters are reported from three subenvironments in the coastal marsh sediments of south Louisiana. Dissolved methane ranged from 8.0 x 10-3 to 7.2 ml/l, with each core demonstrating a slight increase in concentration with depth. The highest concentrations of methane were observed in the northern subenvironment of the marsh, which was low in salinity. Extraction under

vacuum of methane from whole sediment samples indicated that a significant amount of gas is present as bubbles. Total carbon dioxide ranges from 110 to 410 ml/l. Carbon dioxide, extracted under vacuum, yielded carbon isotope ratio values of -18.9 and -22.5 o/oo for the southern and northern areas, respectively. The total carbon dioxide concentration in two areas was greater than or equal to that predicted by the depletion of dissolved sulfate from microbial reduction processes. In one core, however, the total carbon dioxide concentration was less than could be accounted for by the sulfate deficit. In general, where sulfate reduction was active or where the dissolved sulfate concentration was low, the concentration of methane increased. (Katz)
W77-01495

TOXICITY OF 30-MINUTE EXPOSURES OF RESIDUAL CHLORINE TO THE COPEPODS LIMNOCALANUS MACRURUS AND CYCLOPS BICUSPIDATUS THOMASI,
Wisconsin Univ., Milwaukee. Center for Great Lakes Studies.
For primary bibliographic entry see Field 5C.
W77-01507

SPECIFIC ADSORPTION OF TRACE AMOUNTS OF CALCIUM AND STRONTIUM BY HYDROUS OXIDES OF IRON AND ALUMINUM,
Massey Univ., Palmerston North (New Zealand). Dept. of Soil Science.
For primary bibliographic entry see Field 2G.
W77-01513

AMMONIA VOLATILIZATION FROM SURFACE APPLICATIONS OF AMMONIUM COMPOUNDS ON CALCAREOUS SOILS: IV. EFFECT OF CALCIUM CARBONATE CONTENT,
Texas A and M Univ., El Paso. Agricultureal Research Station.
For primary bibliographic entry see Field 2G.
W77-01515

CONVENTIONAL AND CONTROLLED-RELEASE NITROGEN SOURCES FOR RICE,
Arkansas Agricultural Experiment Station, Stuttgart. Rice Branch Experiment Station.
For primary bibliographic entry see Field 3F.
W77-01516

PROPOSED ANIMAL WASTE REGULATIONS FOR WISCONSIN,
Wisconsin Univ., Madison. Dept. of Soil Science.
For primary bibliographic entry see Field 5G.
W77-01526

DAIRY MANURE UTILIZATION AND FIELD APPLICATION RATES,
J. L. Meyer, R. S. Rauschkolb, and E. Olson. (1976). 14 p. 3 fig, 3 tab, 9 ref.

Descriptors: *Salts, *Nitrogen, *Crop response, *Nutrients, Liquid wastes, Solid wastes, Soil profile, Leaching, Denitrification, *Farm wastes.
Identifiers: *Dairy manure, Volatilization.

Alarm concerning nutrient and other salt movement in soils and their possible entry into water supplies has caused researchers to examine dairy manure management practices. It has been found that in storing solid wastes, deep percolation losses of nutrients and salts can be prevented by not disturbing the bottom of the pack. Also, liquid waste storage ponds have been found to be self-sealing. Both liquid and solid dairy wastes have been found to be beneficial when applied to crops. The key to conserving nitrogen applied to the croplands is to incorporate it into the soil as soon as possible in order to prevent denitrification or leaching. Factors affecting nitrogen availability and conservation include: amount of nitrogen released for plant use, method of application, handling, storage between collection and use and rate of application. Excessive nitrogen from organic or inorganic sources may be leached to the water table. Improved manure management with less nitrogen loss will mean fewer total salts added to the soil, since less manure will be needed to meet the nitrogen requirements of crops. (Penrod-East Central)
W77-01532

INVESTIGATION OF REMOTE SENSING TECHNIQUES FOR AGRICULTURAL FEEDLOT POLLUTION DETECTION,
South Dakota State Univ., Brookings. Remote Sensing Inst.
For primary bibliographic entry see Field 5A.
W77-01533

DISPOSAL OF BEEF FEEDLOT MANURE,
Texas Agricultural Experiment Station, College Station.
For primary bibliographic entry see Field 5E.
W77-01536

WATER QUALITY AND MANAGEMENT CHARACTERISTICS OF FEEDLOT RUNOFF HOLDING PONDS,
Illinois Univ., at Urbana-Champaign. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 5D.
W77-01537

INTERACTIONS OF BEEF CATTLE WASTES WITH SOIL,
F. A. Norstadt, and L. K. Porter.
In: Environmental Biogeochemistry, Vol. 2, Chapter 47, Ann Arbor Science, Ann Arbor, Michigan, p. 763-775, 1976. 4 fig, 7 tab, 8 ref.

Descriptors: *Soil profiles, *Cattle, *Feed lots, *Sampling, Groundwater, *Farm wastes, Water pollution sources.
Identifiers: *Manure pack, *Soil water tensions, *Soil temperature, *Soil gases.

A soil core study was conducted at a commercial feedlot in Fort Collins, Colorado in 1972. The soil was a silty-clay loam with a water table varying between 240 and 360 cm, according to season and irrigation scheduling of adjacent cropland. Two metal cylinders or caissons were installed to a depth of 450 cm in a nearly square pen. One was located two meters from the feedbunk concrete apron (area receiving the most animal traffic, urine and feces) and the other in the center, about 30 m away from the bunk caisson (area of less traffic and excretion.) A third caisson was located in a nearby alfalfa field for comparison. The lot was usually stocked at 30 m2 per animal. The caissons monitored five depths (15, 60, 90, 180, and 270 cm) for soil water tensions and soil temperatures and permitted sampling of soil gases and soil solutions. Study results indicated that differences in animal traffic and excretion distribution in the feedlot caused 2 distinct soil regions to develop -- one aerobic, and one anaerobic. The former was near the center of the lot, and the latter was along the concrete apron in front of the feedbunk. Essentially the feedlot surface was sealed and little if any water infiltrated and percolated. Soil water tensions were stable during the year in the upper feedlot soil profile as compared to alfalfa field. The composition of soil gases differed markedly among the 3 caisson sites. It was found that the soil and micro-organisms responded with interesting reactions not easily observed in cultivated soils. The authors concluded that a northeastern Colorado feedlot, stocked and managed as reported in the study, does not appear to be a hazard to soil and groundwater. (Penrod-East Central)
W77-01539

GROUND-WATER CONTAMINATION BY DISSOLVED NITRATE,
Missouri Univ., Columbia. Dept. of Geology.
W. D. Keller, and G. E. Smith.
Presented at 164th Meeting of Geological Society of America, Miami, Florida, 27 p. 3 fig, 3 tab.

Descriptors: *Nitrates, *Fertilizers, Geochemistry, *Missouri, Surveys, *Farm wastes, *Groundwater, *Water pollution sources, Dissolved solids.

This report is concerned with a brief comment on the geochemistry of the NO3 ion and a progress survey of high-nitrate subsurface water in Missouri. Nitrates in Missouri subsurface waters were investigated by collecting water from wells and springs. More than 5,000 water samples were collected and analyzed. Approximately 42 percent of the samples ranging from 12 to 75 percent of the samples from individual counties, contained over 5 ppm nitrogen. The dominant source of water-pollutant nitrate in Missouri water table was found to be nitrogenous waste material from farm feed lots. Heavy application of nitrate fertilizers on highly permeable, alluvial soils, may contribute to the nitrate content of water table wells. (Cartmell-East Central)
W77-01542

A HANDBOOK FOR ESTIMATING THE POLLUTION POTENTIAL OF BEEF, DAIRY, SHEEP AND SWINE FEEDLOTS IN THE NORTH CENTRAL REGION,
R. L. Mensch.
Project Report for Consulting Work Performed for the Farm Structures Division, Agricultural Engineering Department, University of Illinois, Urbana, June, 1971, 29 p. 18 fig.

Descriptors: *Feed lots, *Livestock, *Agricultural runoff, Cattle, Dairy industry, Sheep, Hogs, Climatic data, *Farm wastes, Water pollution.
Identifiers: *North Central U.S., *Pollution potential.

The primary objectives in preparing this handbook are: (1) present procedures so that non-engineers can make on-site evaluation of a feedlot's pollution potential, (2) simplify mathematics so they can be performed without a computer or slide rule, and (3) reduce the number of instruments needed in securing field data to a minimum. A literature review was conducted to pull together the various procedures and equations of evaluating a feedlot's pollution potential in order to provide a continuous evaluation of the system, going from one component to the next. Selected references are cited. Evaluation of a feedlot must include climatic data as well as other factors such as: number of animals, type of animals, ration, percentage of time during the year that the feedlot is in use, feedlot area, lot slope and slope length, and feedlot management. All factors are compiled into a two page worksheet for the computation of feedlot runoff pollution. (Penrod-East Central)
W77-01543

LAND SPREADING OF MANURE FROM ANIMAL PRODUCTION UNITS,
Newcastle-upon-Tyne Univ. (England). Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 5E.
W77-01544

5C. Effects Of Pollution

TEMPERATURE VARIATION IN FIDDLER CRAB MICROHABITATS,
Texas Univ. at Austin, Port Aransas. Marine Science Inst.
L. W. Powers, and J. F. Cole.
Journal of Experimental Marine Biology and Ecology, Vol. 21, 1976, p 141-157, 7 fig, 4 tab, 26 ref.

Descriptors: Environmental effects, *Temperature, Behavior, *Crabs, Microenvironment, Adaptation, *Texas, Resistance, Water pollution effects, Lethal limit.
Identifiers: *Fiddler crabs, Uca panacea, Uca virens.

Data obtained from measurements of the thermal environment at the microhabitat level were used to evaluate seasonal, diel, and spatial patterns of activity of non-tidal fiddler crabs (Uca panacea and Uca virens). The crabs occupy a variety of microhabitats and were active at times during which thermal conditions were not extreme. Wider ranges of temperature and humidity were tolerated during the summer courtship display season. Nocturnal activity was possible during the winter because the heat wave arrives at the burrow terminus several hours after surface maximum. When low temperatures prevail night and day, the crabs remain inactive by day and night. Summer temperatures were high enough to permit activity by day and night. When summer temperatures were above the upper lethal limits, crabs limited their activities to morning and evening periods. (Chilton-ORNL)
W77-01058

NITROGEN FIXATION IN THE RHODE RIVER ESTUARY OF CHESAPEAKE BAY,
Maryland Univ. Baltimore County, Baltimore. Dept. of Biological Sciences.
T. V. Marsho, R. P. Burchard, and R. Fleming.
Canadian Journal of Microbiology, Vol. 21, No. 9, 1975, p 1348-1356, 5 fig, 2 tab, 23 ref.

Descriptors: *Laboratory tests, *Nitrogen fixation, *Estuaries, Sediments, Intertidal areas, Bacteria, *Chesapeake Bay, Plant growth, Water pollution effects, *Bioassay, Eutrophication.
Identifiers: Heterotrophic bacteria.

The reduction of acetylene to ethylene was used as an assay for determining the capacity of biological systems to fix molecular nitrogen in a Chesapeake Bay estuary. Studies conducted over a 15 month period showed that nitrogen fixation occurs predominantly in the surface intertidal and subtidal sediments. Seasonal variation in nitrogen fixation was found for intertidal sediments incubated at 20 C. Average rates of approximately 37 and 12 ng N/g dry sediment per hour were observed in late fall months of 1972 and 1973, and less than or equal to 5 ng N/g dry sediment/hour during other seasons. Incubation of samples at ambient temperatures resulted in lowered peaks of activity. Light-dark and substrate experiments suggested that heterotrophic bacteria were the principal agents for nitrogen fixation in sediments. Seasonal burst of nitrogen fixation potential was out of phase with the period of rapid plant growth. (Chilton-ORNL)
W77-01059

TEMPERATURE AND THE VERTICAL DISTRIBUTION OF TWO TIDEPOOL FISHES (OLIGOCOTTUS MACULOSUS, O. SNYDERI),
Southeastern Massachusetts Univ., North Dartmouth. Dept. of Biology.
R. Nakamura.
Copeia, No. 1, 1976, p 143-152, 4 tab, 6 fig, 34 ref.

Descriptors: Environmental effects, *Temperature, *Distribution, Distribution patterns, Fish, Fish behavior, Tides, Intertidal areas, Estuaries, On-site investigations, *Sculpins, Water pollution effects.
Identifiers: *Oligocottus maculosus, *Oligocottus snyderi.

The relationship between tide cycle, microhabitat, temperatures, microdistribution patterns and thermal physiology of Oligocottus maculosus and Oligocottus snyderi was studied. Temperature was found to vary greatly in tidepools with the magnitude of the variations being governed by the tide cycle and varying according to vertical position, time of day, and season. Distributional differences of the two species studied within the intertidal zone appeared to be mainly due to tidepool temperature regimes. The distribution of O. maculosus was ubiquitous in the intertidal zone while that of O. snyderi was restricted entirely to the lower intertidal zone where temperature regimes were cooler and more stable. (Chilton-ORNL)
W77-01060

DISTRIBUTION AND SIGNIFICANCE OF FECAL INDICATOR ORGANISMS IN THE UPPER CHESAPEAKE BAY,
Maryland Univ., College Park. Dept. of Microbiology.
G. S. Saylor, J. D. Nelson, Jr., A. Justice, and R. R. Colwill.
Applied Microbiology, Vol. 30, No. 4, October 1975, p 625-638, 7 tab, 8 fig, 13 ref.

Descriptors: *Water pollution effects, *Water quality, Waste water(Pollution), Domestic wastes, Sewage, Environmental effects, Shellfish, Recreation, Temperature, Salinity, Bays, *Chesapeake Bay, *Bioindicators, *Distribution, Coliforms, Bacteria, Enteric bacteria, Streptococcus, Aerobic bacteria.
Identifiers: Heterotrophic bacteria.

The survey reported upon provides evidence of significant levels of pollution from human wastes in the water, sediment, and suspended sediment throughout the Upper Chesapeake Bay. Highest counts of pollution indicator organisms were found at the confluence of the Susquehanna River and the Chesapeake Bay. Organisms were found to be quantitatively distributed independently of temperature and salinity and were not correlated with concentration of suspended sediment. However, 53% of total viable bacteria and more than 80% of fecal indicator organisms were directly associated with suspended sediments. Correlation coefficients for the indicator organisms ranged from 0.80 for bottom water to 0.99 for suspended sediment. Prolonged survival for the fecal streptocci was seen in most of the sediment samples. Further deterioration in water quality would seriously affect shellfish harvesting and recreational uses of the Upper Chesapeake Bay. (Chilton-ORNL)
W77-01061

HYDROGEN ION CONCENTRATION IN THE GASTROINTESTINAL TRACT OF CHANNEL CATFISH,
Georgia Agricultural Experiment Station, Savannah.
J. W. Page, J. W. Andrews, T. Murai, and M. W. Murray.
Journal of Fish Biology, Vol. 8, 1976, p 225-228, 2 tab, 8 ref.

Descriptors: Biochemistry *Aquatic animals, Fish, *Hydrogen ion concentration, Laboratory investigations, Temperature, *Channel catfish, Water pollution effects.
Identifiers: Gastrointestinal tract(Catfish).

Two groups of five channel catfish, with average weights of 892 and 134 g, were maintained at environmental temperatures of 23 and 28C. Highly acidic conditions were present in the stomachs of all fish with slightly higher pH values for the stomach contents of fish at 28C. The pH values increased to 7-9 in the duodenum and reached a maximum level of 8.6 in the upper intestinal region with a decrease approaching neutrality in the lower segments of the colon. Catfish of both sizes had a slightly lower pH throughout the intestinal tract at 28C than at 23C. The pH of the bile ranged from 6.1 to 7.5 and was higher in fish maintained at 28C. (Chilton-ORNL)
W77-01062

SEASONAL SHIFTS IN THE SPAWNING SITE OF A NORTHEAST PACIFIC INTERTIDAL FISH,
British Columbia Univ., Vancouver, B. C. Inst. of Animal Resource Ecology.
For primary bibliographic entry see Field 2L.
W77-01063

SEASONAL DISTRIBUTIONS OF LARVAL FLATFISHES (PLEURONECTIFORMES) ON THE CONTINENTAL SHELF BETWEEN CAPE COD, MASSACHUSETTS, AND CAPE LOOKOUT, NORTH CAROLINA, 1965-66,
National Marine Fisheries Service, Highlands, N. J. Sandy Hook Lab.; and National Marine Fisheries Service, Highlands, N. J. Middle Atlantic Coastal Fisheries Center.
For primary bibliographic entry see Field 2L.
W77-01064

MIXED FUNCTION MONOOXYGENASE OF FISH AS AN INDICATOR OF POLLUTION OF AQUATIC ENVIRONMENT BY INDUSTRIAL EFFLUENT,
Oulu Univ. (Finland). Dept. of Pharmacology.
J. T. Ahokas, N. T. Karki, A. Oikari, and A. Soivio.
Bulletin of Environmental Contamination and Toxicology, Vol. 16, No. 3, 1976, p 270-274, 1 tab, 18 ref.

Descriptors: Environmental effects, Water pollution, *Water pollution effects, Waste water(Pollution), Wastes, Industrial wastes, Fish, Aquatic environment, Enzymes, Pollutant identification, *Bioindicators, *Metabolism, *Pikes.
Identifiers: *Monooxygenase.

The pike (Esox lucius L.) was used to determine whether or not fish in polluted water have a higher in vitro capacity to metabolize foreign compounds than those in clean water. The overall trend, contrary to what had been previously reported, was that the fish from the polluted water showed a reduced in vitro mixed function monooxygenase (MFO) capacity. Preliminary exposure studies in which two other species of fish (Salmo trutta lacustris and Salmo gairdneri) were exposed to the polluted water on one and four week periods, did not develop changes such as those seen in pike chronically exposed to the contaminated waters. (Chilton-ORNL)
W77-01065

TOXICITY OF ENDRIN AND AN ENDRIN-METHYL PARATHION FORMULATION TO LARGEMOUTH BASS FINGERLINGS,
North Carolina State Univ., Raleigh. Toxicology Lab.; and North Carolina State Univ. Dept. of Entomology.
D. L. Fabacher.
Bulletin of Environmental Contamination and Toxicology, Vol. 16, No. 3, 1976, p 376-378, 2 tab, 3 ref.

Descriptors: Environmental effects, Pesticides, Fish, *Bass, Fry, *Toxicity, Mortality, *Endrin, Water pollution effects, Pesticide residues, Lethal limit.
Identifiers: *Methyl parathion, LC50.

The purpose was to determine the exact toxicity of endrin and a 1.6-1.6 lbs/gal. endrin-methyl parathion formulation to largemouth bass fingerlings and to determine if the toxicity of the formulation was different from that of endrin alone. The 24 and 48 hour LC50 values for endrin were 0.49 and 0.27 ppb respectively. The 24 and 48 hour LC50 values of the endrin-methyl parathion formulation were 0.48 and 0.37 ppb respectively. (Chilton-ORNL)
W77-01066

MACROPHYTIC ALGAE OF THE VOSTOK BAY (SEA OF JAPAN), (IN RUSSIAN),
Akademiya Nauk SSSR, Vladivostok. Institut Morskogo Biologii.
V. F. Makienko.
Biol Morya Vladivost 2, p 45-57, 1975.

Descriptors: *Algae, *Bays, Chlorophyta, Phaeophyta, Reproduction, Rhodophyta, Seasonal, Tides, Intertidal area.
Identifiers: *Macrophytic algae, *Sea of Japan, *Vostok Bay(USSR).

The species composition and vertical distribution of macrophytes algae from Vostok Bay (the Sea of Japan, Vostok station (USSR) were studied. Vegetation periods and reproductive seasons were also studied. Alga species including Chlorophyta, Phaeophyta and Rhodophyta (19,35 and 66, respectively) were found in the region. The richest species diversity was observed in the intertidal zone. Algal distribution in the bay is shown on a schematic map. Vegetation and reproduction seasons are illustrated by a table.--Copyright 1976, Biological Abstracts, Inc.
W77-01142

MODELING PHYTOPLANKTON BLOOMS IN A STRATIFIED EMBAYMENT,
Utah Water Research Lab., Logan.
W. J. Grenney.
Occasional Paper 8, June 1975. 24 p, 5 fig, 41 ref.

Descriptors: *Phytoplankton, *Mathematical models, *Simulation analysis, *Water quality, Hydrodynamics, *Ecosystems, Nitrogen, Nutrients, Storage, Light intensity, Temperature, Environment, Convection, Dispersion, Equations, Systems analysis, Growth rates, *Eutrophication, Water pollution effects.
Identifiers: Auke Bay(Alaska), Biological models.

A mathematical model has been developed to simulate the nitrogen limited growth dynamics of phytoplankton in a stratified embayment. The representation of biological growth dynamics includes consideration of intracellular nutrient storage as well as the effects of temperature and light intensity. Several competing species can be represented simultaneously. Model hydrodynamics represent the effects of vertical mixing in the water column on the physical distribution of nutrients and phytoplankton. Sinking velocities of the cells are also included. The model was applied to Auke Bay, Alaska, and model responses are compared to data observed during the spring and summer of 1967. The model indicates that phytoplankton populations decrease rapidly with increasing sinking velocity. In conclusion, ecosystems present unique problems for quantitative description and prediction. Mathematical models, although less than perfect, can be powerful tools for analyzing these systems. An optimal balance between accuracy and practicability must be sought. (Bell-Cornell)
W77-01163

COMPOSITION OF THE CARBOHYDRATE COMPLEX OF APHANIZOMENON FLOS-AQUAE (L.) RALFS, (IN RUSSIAN),
Akademiya Nauk URSR, Kiev. Instytut Botaniki.
E. A. Shnyukova, and S. U. Pirozhenko.
Gidrobiol Zh 11(1), p 91-95, 1975.

Descriptors: *Carbohydrates, Cellulose, *Eutrophication, *Algae, Aquatic plants.
Identifiers: *Aphanizomenon-Flos-Aquae, Pectin, Saccharides.

The peak of bloom of a water body caused by the development of a monoculture of A. flos-aquae was accompanied by a increase of the total content of carbohydrates in their cells, mainly due to polysaccharides of the hemicellulose, pectin and cellulose type. A decrease of bloom was attended by a decrease of total carbohydrates. The polysaccharides of A. flos-aquae are distinguished by a large set of monosaccharides. Ten components were established in their hydrolysate.--Copyright 1976, Biological Abstracts, Inc.
W77-01209

KEPONE: HAZARD TO AQUATIC ORGANISMS,
Environmental Protection Agency, Gulf Breeze, Fla. Gulf Breeze Lab.
D. J. Hansen, A. J. Wilson, W. R. Nimmo, S. C. Schimmel, and L. H. Bahner.
Science, Vol 193, No 4253, 13 August 1976. p 528. Letter to the editor.

Descriptors: *Pesticides, *Toxicity, *Mortality, *Bioassay, *Halogenated pesticides, *Freshwater fish, *Estuarine fish, *Commercial fish, Organic pesticides, Minnows, Crabs, Fish reproduction, Spawning, Fecundity, Estuarine pollution, Path of pollutants, Chesapeake Bay.
Identifiers: *Kepone, James River(Va), Bioconcentration, Sheepshead minnows, Grass shrimp, Mysids, Bioaccumulation.

Edible tissues of most estuarine and freshwater fish and invertebrates ranged from 0.1 to more than one microgram per gram. Oysters, grass shrimp and fish concentrated Kepone from 425 to 20,000 times the concentration in the surrounding water. Ninety-six hour LC-50 for Kepone for fish and invertebrates varied from 6.6 to 210 micrograms per liter. Twenty-eight day bioassays indicated mortalities at 0.8 micrograms per liter. Reproduction of fish was affected at 0.08 micrograms of Kepone per liter. (Katz)
W77-01235

WILDLIFE AND OIL SHALE, A PROBLEM ANALYSIS AND RESEARCH PROGRAM. VOLUME II, APPENDIX.
Thorne Ecological Inst., Boulder, Colo.
Fish and Wildlife Service, (Washington, D.C.). Office of Biological Services, 1975. 131 p. Coordinated by H. D. Burke.

Descriptors: *Ecosystems, *Biological communities, *Food chains, *Biota, *Water quality, *Mineral industry, *Mine wastes, *Mining, Niches, Environmental gradient, Industrial wastes, Industrial water, Amphibians, Reptiles, Aquatic animals, Public health, Wildlife, *Bibliographies.
Identifiers: *Oil shale mining, *Oil shale production, *Disease vectors, Blood sucking arthropods.

This bibliography is a collection of 1,045 references that deal with aquatic ecosystems, water quality, terrestrial ecosystems, industrial impacts on wildlife, reptiles and amphibians, blood sucking arthropods and disease vectors. These references will be useful in the description of the region involved in oil shale production and it's environmental processes. (Katz)
W77-01236

THE EFFECTS OF THERMAL EFFLUENT ON THE AMERICAN OYSTER, CRASSOSTREA VIRGINICA GMELIN IN INDIAN RIVER BAY, DELAWARE,
Delaware Univ., Newark. Coll. of Marine Studies.
J. Tinsman, and D. Maurer.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-246 410, Price codes: A06 in paper copy, A01 in microfiche. July 1976, 114 p, 8 tab, 14 fig, 148 ref.

Descriptors: *Thermal stress, Thermal water, *Thermal pollution, Thermal power, *Thermal power plants, *Oysters, Mollusca, Effluents, *Estuaries, *Estuarine environment, Estuarine fisheries, *Industrial wastes, Growth rates, Reproduction, Seasonal, *Delaware, Bays.
Identifiers: *Indian River Bay(Delaware), Glycogen content, *Crassostrea virginica, *Oyster growth, Meat weight.

This report was undertaken in order to determine some of the effects of the thermal discharge from the Delaware Power and Light Company plant at Millsboro, Delaware, on the American oyster, Crassostrea virginica (Gmelin), placed in Indian River Bay. The objectives of the project were to trace the survivorship, growth, condition, and reproductive behavior of oysters held in the thermal effluent and at control stations. The samples were taken from August 1970 to May 1971. The heated effluent had the effect of shortening and modifying the severity of the winter, thereby increasing the growing season. Oysters in the effluent showed the greatest shell growth throughout the study. Meat weights and glycogen concentration in the effluent were highest of all the stations in the winter. Summer conditions in the effluent were severe due to excessively high temperatures and meat weights and glycogen concentrations were lower than at other stations. In the spring, spawning may have occurred prematurely in the effluent at station two, which was located 2.5 km downstream at the mouth of the effluent canal. The study showed that the thermal effluent has both beneficial and detrimental effects depending on the season. (Katz)
W77-01237

INVESTIGATION OF SELECTED POTENTIAL ENVIRONMENTAL CONTAMINANTS, CHLORINATED PARAFFINS,
Syracuse Univ. Research Corp., N.Y.
P. H. Howard, J. Santodonato, and S. J. Saxena.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-248 634, Price codes: A06 in paper copy, A01 in microfiche. Environmental Protection Agency, EPA 560/2-75-007, TR 75-622, November 1975. 109 p, 36 tab, 3 fig, 111 ref.

Descriptors: *Organic compounds, *Chlorinated hydrocarbons, *Chemicals, *Toxicity, Environmental control, Pathology, Analytical techniques, Human diseases, Human pathology, Plants, Microorganisms, Bioassays, Oil industry, Environmental effects, Public health.
Identifiers: Environmental contaminants, *Chlorinated paraffins, Chlorowax, Oil additives, Plasticizers, Flame retardants.

This report reviews the potential environmental hazard from the commercial use of chlorinated paraffins. Chlorinated paraffins, in most cases, contain 10 to 30 carbon atoms and a chlorine content of 40-70%. They are used as lubricating oil additives, secondary plasticizers, and flame retardants. Information on physical and chemical properties, production methods and quantities, commercial uses and factors affecting environmental contamination, as well as information related to health and biological effects, are reviewed. (Katz)
W77-01238

MINERAL REQUIREMENTS IN FISH--II. MAGNESIUM REQUIREMENT OF CARP,
Tokyo Univ. of Fisheries, 4, (Japan). Lab. of Fish Nutrition.
C. Ogino, and J. Y. Chion.
Bulletin of the Japanese Society of Scientific Fisheries, Vol 42, No 1, p 71-75, 1976. 5 tab, 1 fig, 10 ref.

Descriptors: *Magnesium, *Nutrient requirements, *Nutrients, *Carp, *Deficient elements, *Fish diets, *Calcium, *Fish physiology, *Growth rates, Essential nutrients, Fish diseases, Metabolism, Metals, Laboratory tests, Mortality, Methodology.
Identifiers: *Mineral needs.

Magnesium deficiency in carp was found to produce a loss of appetite, poor growth, high mortality, sluggishness and convulsions. The minimal requirement of young carp for magnesium was 0.04 to 0.05 per cent of a dry diet of 12 to 15 mg per kg body weight per day under the experimental

conditions. The magnesium content of vertebrate from carp fed diets containing low magnesium decreased significantly while the calcium content increased slightly. Thus, the values for Ca/Hg of the vertebrae were changed by the dietary magnesium level. (Katz)
W77-01239

ON THE ACUTE TOXICITY OF HERBICIDES FOR SELECTED AQUATIC ORGANISMS. II. TRIAZIN HERBICIDES AND AMITROL (ZUR AKUTEN TOXIZITAT VON HERBIZIDEN GEGENUBER AUSGEWAHLTEN WASSERORGANISMEN. TEIL 2: TRIANZINHERBIZIDE UND AMITROL),
Institut fuer Wasserwirtschaft, Berlin (East Germany).
M. Tscheu-Schluter.
Acta Hydrochimica et hydrooiologica, Vol 14, No 2, p 153-170, 1976. 4 fig, 7 tab, 17 ref.

Descriptors: *Algae, *Bioassay, *Toxicity, *Pesticide residues, *Triazine pesticides, *Organic pesticides, *Aminotriazole, *Herbicides, Environmental effects, Water quality control, Laboratory tests, Water pollution effects.
Identifiers: Poecilia sp, Ankistrodesmus sp, Simazin, Atrazin, Propazin, Desmetryn, Ametryn, Prometryn, Amitrol, Azaplant, Guppies.

The toxic effects of Simazin, Atrazin, Propazin, Desmetryn, Ametryn, Prometryn, Amitrol and Azaplant on Ankistrodesmus falcatus and Poecilia reticulata were examined. At threshold concentrations of less than 1 mg/l the Triazines are highly toxic to Ankistrodesmus, and at threshold concentrations of less than 10 mg/l they are highly toxic for Poecilia. For the six Triazines, relationships exist between the toxicity to algae and the chemical structure. With a wetting agent added, Azaplant is more toxic to fish than the pure agent. The highest allowable herbicide concentrations are given. (Katz)
W77-01240

THE EFFECT OF TEMPERATURE ON THE BEHAVIOR OF YOUNG TAUTOG, TAUTOGA ONITIS (L.),
National Marine Fisheries Service, Highlands, N.J. Sandy Hook Lab.
B. L. Olla, and A. L. Studholme.
In: Proceedings 9th European Marine Biology Symposium, H. Barnes, ed., Aberdeen University Press, 1975, p. 75-93, 4 tab., 5 fig., 16 ref.

Descriptors: *Temperature, *Fish behavior, *Environmental effects, *Benthic fauna,*Heated water, *Feeding rates, *Social behavior(Animal), *Juvenile fish, Laboratory test, Bottom fish, Food habits, Habitats, *Thermal pollution, *Thermal stress.
Identifiers: *Tautoga onitis, Tautog.

A series of experiments were conducted to investigate the effect of temperature on the activity, feeding, and shelter dependency of young tautog, Tautoga onitis, an inshore resident of the Atlantic coast from Nova Scotia to South Carolina. For each experiment, two fish were held under controlled laboratory conditions in one of two experimental systems while observations of activity, time spent in the tile shelter, aggressive encounters, and amounts ingested during feeding were recorded. As temperature was increased the various patterns were modified with activity, aggression, and feeding reduced and association with shelter increased. Five of the experimental fish, including two which had lost equilibrium, resumed normal activity and feeding when temperature was lowered to acclimation levels. (Katz)
W77-01241

METABOLIC ADAPTATIONS ON THE AEROBIC-ANAEROBIC TRANSITION IN THE SEA MUSSEL, MYTILUS EDULIS L.,
Utrecht Rijksuniversiteit (Netherlands). Lab. of Chemical Animal Physiology.
A. DeZwaan, A. M. T. deBont, and J. H. F. M. Kluytmans.
In: Proceedings 9th European Marine Biology Symposium, Harold Barnes, ed. Aberdeen University Press, 1975. p 121-138. 3 fig., 5 tab., 16 ref.

Descriptors: *Metabolism, *Amino acids, *Anaerobic conditions, *Aerobic conditions, Biochemistry, Tracers, Animal physiology, *Respiration, *Shellfish, Environmental effects, Methodology, Analytical techniques, Laboratory tests, Crustaceans, Invertebrates, Carbon radioisotopes, *Oxidation-reduction potential, *Mussels.
Identifiers: *Mytilus edulis, *Metabolic pathways.

The distribution of radioactivity over different classes of chemical compounds from marked glucose and glutamate in the sea mussel Mytilus edulis was examined after 2.5 n of aerobiosis and anaerobiosis. The anaerobic condition was started 15 h preceding the injection of the precursor. The switch to aerobic conditions caused inhibition in the conversion of glutamate, but the conversion of glucose was unaffected. For both precursors under anaerobic conditions the organic acids and amino acids together accounted for about 90% of the radioactivity, and under aerobic conditions for about 55%. Only alanine, aspartate and glutamate were involved. The influence of 17.5 h anaerobiosis on the concentration of glycogen, glucose, succinate, aspartate, glutamate, and alanine were studied. Only succinate showed a marked change, rising by a factor of 10. The results indicate that glutamate is used under both conditions but that the main source of succinate during anaerobiosis is carbohydrate. Glutamate only plays a minor role in the maintenance of the redox balance. (Katz)
W77-01242

MODIFIED BIOASSAY PROCEDURE FOR TOXIC EFFLUENTS,
Jyvaskyla Univ. (Finland). Dept. of Biology.
For primary bibliographic entry see Field 5A.
W77-01243

LCH FLUCTUATIONS IN MYTILUS EDULIS L. IN RELATION TO SHELL MOVEMENTS UNDER AEROBIC AND ANAEROBIC CONDITIONS,
Utrecht Rijksuniversiteit (Netherlands). Lab. of Chemical Animal Physiology.
T. C. M. Wijsman.
Proceedings, 9th European Marine Biology Symposium, Harold Barnes, ed., Aberdeen University Press, 1975. p. 139-150, 8 fig., 1 tab., 21 ref.

Descriptors: *Mussels, *Hydrogen ion concentration, *Acidity, *Environmental effects, *Bioassay, *Animal behavior, *Behavior, *Movement, *Animal physiology, *Aerobic conditions, *Anaerobic conditions, *Shellfish, *Metabolism, Water properties, Laboratory tests, Methodology, Crustaceans, Invertebrates, Enzymes, Biochemistry.

Continuous recordings of shell movements and pH in the extrapallial fluid of Mytilus edulis have been made under aerobic and anaerobic conditions. Short-term measurements of the pH in the foot were made after various periods of exposure to air. In both cases the pH decreases more than 0.3 units within 5 h of shell closure and after 1 day pH values of about 6.6 were obtained, caused by pH reductions of 0.5 to 0.9 units. If the mussel opens its shell on return to sea water, the pH reaches normal values of 7.3 to 7.5 within 2 hrs. A physiological significance of the pH reduction during anaerobiosis is found in the pH-dependence of the enzyme activities of pyruvate kinase and phosphoenolpyruvate carboxykinase. (Katz)
W77-01244

EFFECTS OF THE COOLING WATER DISCHARGE ON THE MACROINVERTEBRATES AND FISH POPULATIONS AROUND FLEVO POWER STATION,
R. H. Hadderingh.
Verhandlungen International Vereinigung fuer theoretische und ungewandte Limnologie. Vol. 19, p. 2214-2218, November 1975. 5 fig., 3 ref.

Descriptors: *Heated water, *Temperature, Population, Environmental effects, *Thermal water, *Cooling water, Powerplants, *Invertebrates, *Benthic fauna, Effluents, *Reproduction, *Growth rates, *Pikes, Water pollution sources, Water pollution effects, Distribution patterns, On-site investigations, Diptera, Oligochaetes, Snails, Worms, Crustaceans, *Thermal pollution.
Identifiers: Bream.

Investigations have been made for several years on the influence of warm cooling water on fish and macroinvertebrates around the Flevo power station. Changes in the macroinvertebrates are limited to small area around the outlet where temperatures are relatively high. These changes included increased growth rate, earlier hatching of eggs and population variations. With a few exceptions all of the more commonly occurring species were found near both the intake and the outlet. Fish were markedly more abundant near the outlet than elsewhere in the lake. Negative effects on fish condition were found in pike-perch and bream. The spawning time of roach was advanced by about two weeks near the outlet. (Katz)
W77-01245

SPATIAL DISPERSION OF AN ESTUARINE BENTHIC FAUNAL COMMUNITY,
Swedish Water and Air Pollution Research Lab., Goteborg.
For primary bibliographic entry see Field 5B.
W77-01246

AROMATIC HYDROCARBONS IN AQUATIC FAUNA,
Atlantic Biological Station, St. Andrews (New Brunswick).
For primary bibliographic entry see Field 5A.
W77-01247

THE EFFECTS OF MIREX AND METHOXYCHLOR ON THE GROWTH AND PRODUCTIVITY OF CHLORELLA PYRENOIDOSA,
Wheaton Coll., Norton, Mass. Dept. of Biology.
J. C. Kricher, J. C. Urey, and M. L. Hawes.
Bulletin of Environmental Contamination and Toxicology, Vol. 14, No. 5, p. 617-620, 1975. 2 tab., 8 ref.

Descriptors: *Chlorinated hydrocarbon pesticies, *Pesticides, *Insecticides, *Primary productivity, *Bioassay, Chlorella, *Algae, *Aquatic populations, *Growth rates, Photosynthesis, Laboratory tests, Water pollution effects, Aquatic plants, Aquatic algae, Plant growth.
Identifiers: *Mirex, *Methoxychlor, *Chlorella pyrenoiodosa.

The effects of mirex and methoxychlor, two chlorinated hydrocarbon pesticides, on the population growth of Chlorella were examined. Populations treated with 100 ppb mirex were depressed by 8% compared to controls after 92 hr. The population density was 19% below that of the control at the end of the experiment after exposure to mirex. Populations treated with 100 ppb methoxychlor were 17% lower than controls when the experiment was ended. The populations exposed to 50 ppb mirex and 50 ppb methoxychlor in combination showed little deviation from the control group. This suggests that the two pesticides effect different physiological processes and that 50 ppb

of each pesticide was below the toxicity threshold for Chlorella. (Katz)
W77-01248

DAILY PATTERN OF NITROGEN EXCRETION AND OXYGEN CONSUMPTION OF SOCKEYE SALMON (ONCORHYNCHUS NERKA) UNDER CONTROLLED CONDITIONS,
Fisheries and Marine Service, Nanaimo (British Columbia). Biological Station.
J. R. Brett, and C. A. Zala.
Journal of the Fisheries Research Board of Canada, Vol. 32, p. 2479-2486, 1 tab., 3 fig., 19 ref.

Descriptors: *Metabolism, *Ammonia, *Nitrogen compounds, *Salmon, *Sockeye salmon, *Diurnal, *Oxygen, *Ureas, Laboratory tests, Biorhythms, Aquiculture, Fish hatcheries, Fish management.

Measurements of the rate of ammonia and urea excretion of fingerling sockeye salmon (Oncorhynchus nerka) (average weight -29 grams) were made at 2-3-hourly intervals throughout the day. One group of fish was fed a maintenance ration while another group was starved for 22 days. Ammonia excretion rose to a sharp peak of 35 mg N/kg per hour, 4-4.5 h after the start of feeding (at 0830) and fell to a baseline level of 8.2 mg N/kg per hour between 0200 and 0800. Urea excretion remained relatively steady at a mean rate of 2.2 mg N/kg per hour throughout the day, showing no diurnal response to feeding. Starved fish showed a nitrogen excretion rate close to that for both the steady state of urea excretion and the baseline rate of ammonia excretion of the fed fish. Oxygen consumption rose to 370 mg 02/kg per hour just before and during a 1-h feeding period, decreasing to a low of 170 mg 02/kg per hour at 0300 h. For the starved fish this diurnal metabolic fluctuation continued from the start in a variable and diminishing form whereas nitrogen excretion showed no such response. It is concluded that for nonstressed salmon at 15C ammonia is the chief excretory product of exogenous nitrogen metabolism. (Katz)
W77-01250

SYNERGISM OF INHIBITING ACTIONS OF HEAVY METALS UPON THE FERTILIZATION AND DEVELOPMENT OF SEA URCHIN EGGS, (IN JAPANESE),
Doshisha Univ., Kyoto (Japan). Biological Lab.
N. Kobayashi, and K. Fujinaga.
The Science and Engineering Review of Doshisha University, Vol. 17, No. 1, p. 54-69, April, 1976. 7 tab., 2 fig., 13 ref.

Descriptors: *Reproduction, *Heavy metals, *Copper, *Zinc, *Nickel, *Cadmium, *Fertilization, Water pollution effects, *Growth rates, *Growth stages, Animal pathology, Eggs.
Identifiers: *Synergistic effects, *Anthocidaris sp., *Hemicentrotus, Sea urchin eggs.

The effects of copper, zinc, nickel and cadmium on fertilization, cell division, and gastrulation of sea urchin eggs were studied, both as individual metals and paired. Hemicentrotus pulcherrimus and Anthocidaris crassispina were exposed to concentrations of metals at 2, 4, and 8 times the maximum level of non-inhibition. Hemicentrotus was more sensitive to the effect of heavy metals than was Anthocidaris. Decreased fertilization rates, cell division, and gastrulation resulted from heavy metals exposure as did the appearance of polyspermy, permanent blastula and exogastrula, and delay of development. Strong synergistic effects occurred with Cu plus Zn, and less strongly with Cu plus Cd and Zn plus Cd. Cu plus Ni, Zn plus Ni, and Ni plus Cd resulted in an additive inhibition. (Katz)
W77-01251

APPLICATION OF 24-HOUR POSTEXPOSURE OBSERVATION TO ACUTE TOXICITY STUDIES WITH INVERTEBRATES,
Viterbo Coll., LaCrosse, Wis. Dept. of Biology.
C. R. Hansen, Jr., and J. A. Kawatski.
Journal of the Fisheries Research Board of Canada, Vol. 33, p. 1198-1201, 1976, 1 tab., 10 ref.

Descriptors: *Laboratory tests, Methodology, *Toxicity, *Bioassay, *Dieldrin, *Invertebrates, *Midges, *Analytical techniques, *Mortality, *Testing procedures, Stress, Lethal limit, *Pollutant identification.
Identifiers: *Malathion, *Endothal, *Carbaryl, *TFM, Chironomus tentans, Cypretta kawatai.

Experimentation with carbaryl, dieldrin, endothal, malathion, and TFM (3-trifluoro-methyl-4-nitrophenol) on the ostracod Cypretta kawatai and the midge Chironomus tentans demonstrated that the method of routine toxicity tests with invertebrates can be substantially improved by including a posttreatment (toxicant free water) observation period. This improvement enables confirmation of death and thereby reveals latent toxicity or recovery. (Katz)
W77-01252

INFECTIOUS PANCREATIC NECROSIS: TRANSMISSION WITH IODINE-TREATED AND NONTREATED EGGS OF BROOK TROUT (SALVELINUS FONTINALIS),
Bureau of Sport Fisheries and Wildlife, Kearneysville, W. Va. Eastern Fish Disease Lab.
G. L. Bullock, R. R. Rucker, D. Amend, K. Wolf, and H. M. Stuckey.
Journal of the Fisheries Research Board of Canada, Vol. 33, p. 1197-1198, 1976. 5 ref.

Descriptors: *Fish diseases, *Fish eggs, *Brook trout, Diseases, *Infection, *Pest control, *Viruses, *Epidemiology, Trout, Salmonids, Biocontrol, Laboratory tests, Iodine, Disinfection.
Identifiers: *Salvelinus fontinalis, *Infectious pancreatic necrosis.

Experiments conducted simultaneously at two laboratories have shown brook trout (Salvelinus fontinalis) egg transmission of the virus of infectious pancreatic necrosis with eggs treated with 100 ppm iodine (as Wescodyne(R) and with nontreated eggs. (Katz)
W77-01253

COMPARATIVE MORTALITY STUDIES ON BIOMPHALARIA GLABRATA (MOLLUSCA: PULMONATA) EXPOSED TO COPPER INTERNALLY AND EXTERNALLY,
Lehigh Univ., Bethlehem, Pa. Inst. for Pathobiology.
J. T. Sullivan, and T. C. Cheng.
Journal of Invertebrate Pathology, Vol. 28, p. 255-257, 1976. 1 fig., 3 ref.

Descriptors: *Copper, Animal physiology, *Animal pathology, *Snails, *Toxicity, *Mortality, *Mode of action, *Path of pollutants, Metals, Gastropods, Invertebrates, Methodology, Mollusks.
Identifiers: *Biomphalaria glabrata, Copper sulfate.

Various concentrations of copper in the form of CuS04 were injected into the hemocoel of Biomphalaria glabrata, and mortality of this snail was subsequently monitored. The concentrations of copper in the hemolymph of injected snails were calculated, and specimens were incubated in these concentrations. Greater mortality was observed when snails were incubated in concentrations of copper than when they were injected with a sufficient amount of copper to attain these same concentrations in the hemolymph. Injection of copper into the hemocoel of B. glabrata resulted in the formation of a noncellular hemolymph precipitate, most likely denatured proteins, at the injection site, which was most noticeable with higher concentrations of copper. It has been concluded that external concentrations of copper are more cidal to B. glabrata than are internal, i.e., injected, concentrations. These data support the hypothesis that the cidal action of copper on B. glabrata is due to an attack on the mollusc's surface epithelia. (Katz)
W77-01254

PCB CONTENTS IN MARINE ANIMALS COLLECTED IN THE EAST CHINA SEA, (IN JAPANESE),
Hokkaido Univ., Sapporo (Japan). Lab. of Food Hygiene.
M. Takagi, A. Iida, and S. Oka.
Bulletin of the Japanese Society of Scientific Fisheries, Vol. 42, No. 7, p. 753-759, 1976. 3 tab., 4 fig., 19 ref.

Descriptors: *Polychlorinated biphenyls, *Absorption, *Path of pollutants, *Marine animals, *Pesticide residues, Chlorinated hydrocarbon pesticides, Water Pollution Sources, Analytical techniques, Pacific Ocean.
Identifiers: *East China Sea, Tissue analysis, *Kanechlor-600.

Twenty one species of marine animals were collected from the East China Sea. Muscle and liver tissues were analyzed for polychlorinated biphenyl (PCB) concentrations. PCB concentrations in muscle ranged from 0.01-0.06 ppm and from 0.08-0.28 ppm in liver. Bloody muscle contained higher PCB concentrations than did ordinary muscle. Kanechlor-600 (KC-600) was absent from muscle, but distinctly present in liver of all marine animals tested except Fugu chinensis. The median and standard deviation of the PCB concentration in muscle tissue showed 0.018 ppm and 0.250 ppm, respectively. Consequently, the degree of pollution with PCB of marine animals in the East China Sea was found to be very low as compared with that of fish from other areas. (Katz)
W77-01255

ACUTE TOXICITIES OF CRUDE OILS AND OIL-DISPERSANT MIXTURES TO RED SEA FISHES AND INVERTEBRATES,
Hebrew Univ., Jerusalem (Israel). Heinz Steinitz Marine Biology Lab.
R. Eisler.
Israel Journal of Zoology, Vol. 24, p. 16-27, 1975. 7 tab., 10 ref.

Descriptors: *Oil, *Oil wastes, *Toxicity, *Bioassay, *Mollusks, *Lethal limit, Water pollution sources, *Crustaceans, *Marine fish, Marine animals, Stress, *Pollution abatement, Water pollution effects, Invertebrates, Coral, Laboratory tests, Benthic fauna, Oil spills, Gastropods, Mussels, Animal behavior.
Identifiers: *Oil dispersants, *Crude oil, Heteroxenia fuscescens, Nerita forskali, Drupa granulata, Mytilus variabilis, Palaemon pacificus, Siganus rivulatus, *Persian Gulf, Gulf of Elat, *Red Sea.

Crude oil from fields in the Persian Gulf and in the Sinai plus a chemical oil dispersant were tested, using static bioassay procedures, for toxicity to adults or juveniles of ten marine species: Heteroxenia fuscescens, a soft coral; Nerita forskali and Drupa granulata, gastropod molluscs; Mytilus variabilis, a mussel; Acanthopleura haddoni, a chiton (mollusc); Echinometra mathaei, sea urchin; Calcinus latens, a hermit crab; Palaemon pacificus, a shrimp; Parupeneus barberinus, goatfish; and Siganus rivulatus, rabbitfish. Concentrations fatal to 50% of individual test species in 168 hours, LC-50 (168 h), ranged from 0.74 to more than 30.0 ml/liter for Persian Gulf crude, from 14.5 to more than 30.0 ml/liter for Sinai crude, and from 0.006 to 0.064 ml/liter for the dispersant. In general, fishes and crustaceans were the most sensitive groups assayed and molluscs the most resistant. LC-50 (168 h) values for oil-dispersant

mixtures of 10 parts oil t 1 part dispersant (v/v) for selected species ranged from 0.047 to 0.152 ml/liter which appears to reflect the biocidal properties of the dispersant. Some individuals that survived immersion in high concentrations of the test compounds for 168 h were adversely affected during treatment and afterwaRDS. (Katz)
W77-01256

THE ENVIRONMENTAL CHEMISTRY OF COPPER (II) IN AQUATIC SYSTEMS,
Australian Atomic Energy Commission Research Establishment, Lucas Heights, Div. of Chemical Technology.
For primary bibliographic entry see Field 5B.
W77-01257

THE EFFECT OF ARSENIC ON EMBRIONAL DEVELOPMENT OF RAINBOW TROUT (SALMO GAIRDNERI, RICH),
Akademia Rolniczo-Techniczna, Olsztyn-Kortowo (Poland).
K. R. Dabrowski.
Water Research, Vol. 10, p. 793-796, 1976. 2 tab., 3 fig., 17 ref.

Descriptors: *Bioassay, *Rainbow trout, *Absorption, *Fish eggs, *Fish reproduction, *Arsenic compounds, *Toxicity, *Toxins, *Water pollution effects, *Embryonic growth stage, Salmonids, Reproduction, Laboratory tests, Growth stages, Hatching.
Identifiers: *Bioaccumulation, *Arsenic.

Studies were made on the toxic effect and accumulation of arsenic in developing eggs of rainbow trout. Fertile eggs were incubated at 6-7 C in sodium arsenate or arsenic trioxide solution at concentrations of 0.05-50.0 ppm As. The effect of arsenic on the survival of embryos and on the accumulation of the element in eggs were found to be related to the arsenic concentration and to the value of the arsenic ion in the arsenic compound used. (Katz)
W77-01258

MATHEMATICAL ANALYSIS OF THE CHEMICAL SYSTEM 'CYANIDE-HEAVY METALS' IN THE WATER-DETERMINATION OF COMPONENTS AND TOXICITY OF THE SYSTEM-I, THE THEORETICAL SOLUTION,
State Research Inst. of the Textile Industry, Brno (Czechoslovakia) Center for Research and Appplication Ionized Radiation.
For primary bibliographic entry see Field 5B.
W77-01259

MATHEMATICAL ANALYSIS OF THE CHEMICAL SYSTEM 'CYANIDE-HEAVY METALS' IN WATER-DETERMINATION OF COMPONENTS AND TOXICITY OF THE SYSTEM-II, SOLUTION BY COMPUTER,
State Textile Research Inst., Brno (Czechoslovakia). Center for Research and Application Ionized Radiation.
For primary bibliographic entry see Field 5B.
W77-01260

HEAVY METAL AND CHLORINATED HYDROCARBON RESIDUES IN CALIFORNIA SEA LIONS (ZALOPHUS CALIFORNIANUS CALIFORNIAUS),
Oregon State Univ., Corvallis. Dept. of Agricultural Chemistry.
D. R. Buhler, R. R. Claeys, and B. R. Mate.
Journal of the Fisheries Research Board of Canada, Vol. 32, p. 2391-2397, 1975. 4 tab., 28 ref.

Descriptors: *Heavy metals, Path of pollutants, *Absorption, *Chlorinated hydrocarbon pesticides, *Pesticide residues, *Mammals, *Animal pathology, Animal physiology, DDE, Cadmium, Mercury, Environmental effects, Animal diseases, Polychlorinated biphenyl, DDD, DDT, Metabolishm, *Pollutant indentification.
Identifiers: Zalophus californianus calfornianus, *California Sea Lion, Tissue analysis, *Methylmercury, Bioaccumulation.

Samples of various tissues and organs from healthy California sea lions and sick animals (apparently with leptospirosis) collected along the central Oregon coast from 1970 to 1973 were analyzed for total mercury, methylmercury, cadmium, and chlorinated hydrocarbons. Maximum mercury concentrations of 74-170 ppm occurred in sea lion liver, with only 1.6-3.7 percent as methylmercury. Cadmium was concentrated primarily in the kidney which contained 7.2-12.0 ppm of the metal. Chlorinated hydrocarbon residues in sea lion fat ranged between 253-475 ppm DDE, and 21.4 and 34.1 ppm PCB. Although mercury, cadmium, and chlorinated hydrocarbon residues in some of the sick sea lions were significant higher than those present in healthy animals, it is possible to relate these differences to the onset of leptospirosis. (Katz)
W77-01261

LATENT EFFECTS OF IRANIAN CRUDE OIL AND A CHEMICAL OIL DISPERSANT ON RED SEA MOLLUSCS,
Hebrew Univ., Jerusalem (Israel). Heinz Steinitz Marine Biology Lab.
R. Eisler.
Israel Journal of Zoology, Vol. 22, p. 97-105, 1973. 2 tab., 4 fig., 8 ref.

Descriptors: Animal physiology, *Pollution abatement, Oil, Water pollution effects, Environmental effects, *Reproduction, *Predation, *Gastropods, *Feeding rate, *Oil pollution, Stress, Mussels, *Mollusks, Invertebrates, Productivity, Dispersion, Oil spills, Laboratory tests, Food habits, Inhibitors, Physiological ecology.
Identifiers: *Sublethal effects, *Mytilus variabilis, *Oil dispersants, Drupa granulata, *Red Sea mollusks.

Predation rate of the gastropod drill, Drupa granulata, on the mussel, Mytilus variabilis, was measured over a period of 28 days after adults from both species had been immersed for 168 h in seawater solutions containing high sublethal concentrations (10 ml/liter) of Iranian crude oil. Predation rate was three times higher in controls than in the group where both predator and prey had been exposed initially; intermediate values were determined among groups where only one species had been trated initially. Fecundity of drills, as evidenced by number of egg cases deposited, was directly related to mussel consumption. In a similar study with a chemical oil dispersant, exposure to high (0.003 ml/liter) sublethal levels for 168 h did not affect markedly the rate at which mussels were destroyed an consumed during post-treatmet. However, the fecundity of untreated drills feeding on untreated mussels (controls) was 3 to 10 times greater than among groups in which one or both species had been exposed initially to dispersant. Except for mussels consumed by drills, there were no deaths during the post-treatment period in either study, and all organisms appeared normal. (Katz)
W77-01262

THE ACCUMULATION OF PCB AS A FUNCTION OF GROWTH IN JAPANESE ANCHOVY CAUGHT IN OSAKA BAY, (IN JAPANESE),
Osaka Prefectural Fisheries Experimental Station, (Japan).
H. Joh, S. Yamochi, and T. Abe.
Bulletin of the Japanese Society of Scientific Fisheries, Vol. 42, No. 1, p. 123-130, 1976. 3 tab., 8 fig., 10 ref.

Descriptors: *Polychlorinated biphenyls, *Pesticide residues, *Absorption, *Animal growth, *Lipids, Length, *Path of pollutants, Analytical techniques, Fish migration, Marine fish, Marine pollution.
Identifiers: Engraulis japonica, *Japanese anchovy, *Bioaccumulation, *Osaka Bay(Japan).

Concentration of PCB in Japanese anchovy, Engraulis japonica, from Osaka Bay increases exponentially with body length and proportionally with body weight. In two sample groups with comparatively distinguishable features, the PCB concentration plotted versus body weight gave values which were distributed on two straight lines of differing slopes. It is suggested that one group was hatched in Osaka Bay, and the other in open sea and migrated to Osaka Bay. The difference in the PCB accumulation rate of the two groups is probably due to the different intake of lipids during the limited period of anchovy growth, as indicated by the nearly linear functional relationship between the total oil and the total PCB content of whole anchovy. (Katz)
W77-01265

CHRONIC EFFECTS OF REDUCED PH ON BROOK TROUT (SALVELINUS FONTINALIS),
West Virginia Dept. of Natural Resources Elkins. Div. of Wildlife Resources.
R. Menendez.
Journal of the Fisheries Research Board of Canada, Vol. 33, p. 118-123, 1976. 3 tab., 1 fig., 14 ref.

Descriptors: *Hydrogen ion concentration, Laboratory tests, *Bioassay, *Trout, *Growth rates, Hatching, *Acidic water, *Fish eggs, *Acidity, Environmental effects, *Growth stages, *Fry, Fish reproduction, Water pollution effects, Acid mine wastes, Water quality control, Fish physiology, *Embryonic growth stage.

During an eleven month period all developmental stages of the brook trout (Salvelinus fontinalis) were continuously exposed to pH levels of 4.5, 5.0, 5.5, 6.0, 6.5, and the control of 7.1. The number of viable eggs decreased significantly at pH 5.0 and to a lesser extent at the higher pH levels. Embryo hatchability was significantly less at all pH levels below 6.5. Growth and survival of alevins was reduced at the lower pH levels. These data indicate that continual exposure to pH values below 6.5 will result in significant reductions in egg hatchability and growth. (Katz)
W77-01266

MERCURY IN EGGS OF NORWEGIAN SEABIRDS,
Tromsoe Univ. (Norway). Inst. Biology and Geology.
For primary bibliographic entry see Field 5A.
W77-01267

SOME EFFECTS OF KUWAIT CRUDE OIL ON THE LIMPET, PATELLA VULGATA,
Field Studies Council, Penbroke (England). Oil Pollution Research Unit.
B. Dicks.
Environ Pollut. 5(3), p 219-229, 1973.

Descriptors: *Oil pollution, *Toxicity, Mollusks, *Gastropods, *Testing, Water pollution effects, Oil spills.
Identifiers: *Crude oil, Kuwait, *Limpet, Patella-vulgata.

A simple toxicity test for pollutants associated with the oil industry using the limpet, P. vulgata, is described. This test with an organism of considerable importance to the ecological balance of the rocky shore takes into account some of the criteria likely to be of importance to mortality in natural populations after an oil spillage. As such, it allows some prediction of the ecological effects of an oil spill on the shore. Natural rhythm in activity is shown to affect the susceptibility of the limpet population to crude oil, greatest toxic effects oc-

curring during times of greatest activity. A circadian rhythm is demonstrated in the activity of the limpet. There appears to be no difference in the toxicity of crude oil to large and small specimens.--Copyright 1974, Biological Abstracts, Inc.
W77-01275

LOWER GREEN BAY. AN EVALUATION OF EXISTING AND HISTORICAL CONDITIONS,
Wisconsin Dept. of Natural Resources, Madison.
E. Epstein, M. Bryans, D. Mezei, and D. Patterson.
Report No. EPA-905/9-74-006, June 1974. 293 p. 30 fig., 24 tab., 71 ref., 11 append.

Descriptors: *Bays, *Lake Michigan, *Water pollution effects, *Data collections, *Wisconsin, Oxygen sag, Eutrophication, Water pollution control, Water pollution sources, Biochemical oxygen demand, Benthic fauna, Bottom sediments, Silting, Tributaries, Water circulation, Attitudes, Competing uses, Pulp wastes, Pulp and paper industry, Waste treatment, Sewage effluents, Alkalinity, Nutrients.
Identifiers: *Green Bay(Lake Michigan), Fox River(Wis), Oconto River(Wis), Peshtigo River(Wis), Menominee River(Wis).

The Fox River remains the major pollution source of Green Bay. The BOD-5 and suspended solids discharges from paper mills along the river are now approximately what they were 20 years ago after an intermidiate period of higher loadings;BOD-5 loadings from sewage plants have risen in the past ten years along the Lower Fox River depositing a high content of sludge at the extreme end of the bay. Below Sturgeon Bay there are several areas where the depth has substantially decreased during the past 17 years, an indication that the bay is filling at a higher rate than larger bodies of water. A change in commercial fish species has occurred since 1900 representing a shift from high quality native species to low quality exotics. If pollution of the bay continues the bottom fauna will become the type associated with gross pollution, a larger abiotic area around the river mouth can be expected, midge larvae abundance would decrease further north, and Oligochaetes would become even more dominant. Data for pulp waste loadings to the Lower Fox River, sewage effluents, estimated phosphorus loadings through tributaries to the bay, nitrogen concentrations, suspended solids, chlorides, light transparency, conductivity, fish species, bottom fauna and dissolved oxygen concentrations are compared between 1938 to 1970. (Auen-Wisconsin)
W77-01287

THE NUTRITION OF GREAT LAKES CLADOPHORA,
Wisconsin Univ., Madison. Water Resources Center.
G. C. Gerloff, and G. P. Fitzgerald.
Report EPA-600/3-76-044, April 1976. 120 p. 9 fig., 59 tab., 38 ref.

Descriptors: *Nutrient requirements, *Cladophora, *Vitamin B, *Boron, *Sulfur, *Great Lakes, Cultures, Algae, Nitrogen, Phosphorus, Ammonia, Nitrates, Water pollution, Zinc, Bioassay, Growth rates, Limiting factors.
Identifiers: Cladophora glomerata.

Procedures for laboratory culturing of Cladophora, a nuisance green alga in the Great Lakes, were developed. Cladophora glomerata must have external vitamins B-1 and B-12 supplies. With added vitamins, Cladophora can be cultured in completely defined media. When evaluated as critical cell concentrations (minimum concentrations which permit optimum growth), Cladophora had relatively low nitrogen and phosphorus requirements and very high boron and sulfur requirements. Cladophora can use ammonia- and nitrate-nitrogen and ortho-, pyro-, meta-, and tripoly-phosphorus for growth, but phosphite-phosphorus was relatively unavailable. Cladophora phosphorus concentrations from all the Great Lakes correlated with pollution of specific areas; phosphorus was limiting or close to limiting in areas with little pollution. Phosphorus reduction might be a practical way to reduce Cladophora growth. Nitrogen was not limiting, but boron and possibly zinc and vitamin B-1 may be. Plant bioassays are recommended to evaluate nutrient supplies and growth-limiting nutrients for Cladophora in Natural environments. Critical concentrations and the range of concentrations of nitrogen, phosphorus, calcium, magnesium, potassium, sulfur, iron, zinc, manganese, copper, molybdenum, and boron were determined. Cladophora appeared relatively insensitive to high temperature with optimum yields maintained at 30-31C. Its growth was reduced to 63% of optimum at 16-17.5C. (Buchanan-Davidson--Wisconsin).
W77-01288

WORKSHOP ON TOXICITY TO BIOTA OF METAL FORMS IN NATURAL WATER.
International Joint Commission-United States and Canada.
Held October 7-8, 1975 at Duluth Minnesota. R. W. Andrew, P. V. Hodson and D. E. Konasewich, editors. April 1976. 333 p.

Descriptors: *Heavy metals, *Toxicity, *Great Lakes, *Water quality standards, International Joint Commission, Conferences, Organic compounds, Mode of Action, Mathematical models, Chemical reactions, Pollutant identification, Air environment, Absorption, Biota, Persistence, Distribution, Food webs, Fish, Algae, Bottom sediments, Suspended solids, Chelation, Marine algae, Lethal limit, Solubility, Absorption, Analytical techniques, Speciation, Molecular structure.
Identifiers: Synergistic effects, Antagonistic effects, Additive effects, Toxic units, Metal detoxification, Bioaccumulation, Stability constants, Application factor.

This proceedings focused on the current knowledge concerning the toxicity and availability to aquatic biota of various forms and molecular complexes of metals to assist the International Joint Commission's Water Quality Board in developing water quality objectives for the Great Lakes. The chemistry of heavy metals was reviewed and the total, soluble, particulate, extractive, colloidal, chelated, complexed, bound, hydroxides, chlorides, carbonates and sulfates were considered in terms of total metal. Of prime interest was the relationship of metal forms to toxicity, and if that can be established, how it can be measured with sufficient sensitivity and accuracy. Presentations discussed the molecular structure-activity relations and their toxicity, and metal speciation and their toxicity. Other contributions discussed heavy metal standards on the basis of their dissolved forms, effects of organic pollutants on copper toxicity to fish, copper toxicity to phytoplankton as affected by organic ligands, other cations, and algal tolerance. Presentations also dealt with complexation of metals, potential roles of metal-ligands in seawater, distribution and bioaccumulation of mercury, pharmokinetic approaches to the evaluation of methylmercury to fishes, molecular forms of arsenic, and additive actions and interactions in the toxicity of mixtures of heavy metals and organic compounds. The final chapter is devoted to a comprehensive discussion and research needs. (See W77-01296 thru W77-01309) (Auen-Wisconsin)
W77-01295

COMPLEXATION OF METALS IN NATURAL WATER,
Canada Centre for Inland Waters, Burlington (Ontario).
Y. K. Chau, and P. T. S. Wong.
In: International Joint Commission's Workshop Proceedings 'Toxicity to Biota of Metal Forms in Natural Water', October 7-8, 1975, Duluth, Minn. p 187-196, April 1976. 3 fig, 1 tab, 9 ref.

Descriptors: *Heavy metals, *Toxicity, *Chelation, Organic matter, Copper, Algae, Canada, Lead, Zinc, Nickel, Scenedesmus.
Identifiers: Metal detoxification, Ligands, Ankistrodesmus falcatus, Sudbury(Ontario).

A significant fraction of the trace metals in waters is believed to exist in complexed forms with miscellaneous organic ligands, whose abundance and complexing characteristics regulate the availability of heavy metals to biota. The forms of metals, toxic effects, complexing capacity of water and its effect in ameliorating metal toxicity are discussed. Tests conducted with lake waters in the Sudbury, Ontario, district showed a correlation between complexing capacity with either dissolved organic carbon or dissolved organic nitrogen or both. The relationship between complexing capacity of a lake and algal growth was studied with Ankistrodesmus falcatus in waters containing high concentrations of zinc, nickel, copper and lead, and all exhibited varying degrees of toxicity. Further experiments on the relationship between complexation and toxicity reduction to algae with Scenedesmus quadricauda were conducted with 500 ppb lead, with various degrees of growth inhibition. The toxic effects of metals in an aquatic system depend greatly on several factors, with complexing capacity the most significant; other factors affecting toxicity are alkalinity, hardness, nutrient concentration and pH. Unless it is possible to vary the complexing capacity of water samples without changing the other parameters, the sole effect of complexing capacity cannot be quantitatively assessed. At present it is impossible to vary the amount of ligands without altering the other parameters. (See also W77-01295) (Auen-Wisconsin)
W77-01296

DISTRIBUTION AND BIOACCUMULATION OF MERCURY IN BIOTIC AND ABIOTIC COMPARTMENTS OF A CONTAMINATED RIVER-RESERVOIR SYSTEM,
Oak Ridge National Lab., Tenn.
S. G. Hildebrand, A. W. Andren, and J. W. Huckabee.
In: International Joint Commission's Workshop Proceedings 'Toxicity to Biota of Metal Forms in Natural Water', October 7-8, 1975, Duluth, Minn. p 211-230, April 1976. 4 fig, 5 tab, 30 ref. NSF (RANN) AG-389.

Descriptors: *Mercury, *Biota, *Distribution, Benthos, Fish, Food webs, Absorption, Virginia, Tennessee, Bottom sediments, Suspended solids, Shiners, Suckers, Rock bass, Heavy metals.
Identifiers: *Bioaccumulation, *Methylmercury, North Fork Holston River(Va), Cherokee Reservoir(Va), Hogsuckers, Chlor-alkali plant.

Studies were conducted in the North Fork of the Holston River-Cherokee Reservoir, Virginia, which receives leached mercury from an abandoned chlor-alkali plant's waste disposal ponds, to determine the behavior and ultimate fate of mercury in that system. The dissolved mercury is rapidly adsorbed onto suspended particulates and the major downstream transport of mercury appears to take place in the particulate phase. Total mercury and methylmercurials in fish and benthic invertebrate taxa were highest immediately below the source then decreased downstream. The pattern was similar to the downstream distribution of mercury in water and sediments. Total mercury in rockbass 83 miles downstream from the source exceeded 1.0 ppm. Approximately 80% of mercury in rock bass, hogsucker, and shiners in the river was methylmercury and on the order of 50% of mercury in benthic invertebrates was methylmercury. No methylmercury had been detected in river bed sediments. Dietary uptake of methylmercury by fish feeding on benthic invertebrates may be a significant route of entry of methylmercury into food webs but the mechanism of accumulation of methylmercury in the three fish species is unresolved. (See also W77-01295) (Auen-Wisconsin)
W77-01297

ZINC SPECIATION AND TOXICITY TO FISHES,
Montana State Univ., Bozeman. Dept. of Chemistry.
G. K. Pagenkopf.
In: International Joint Commission's Workshop Proceedings 'Toxicity to Biota of Metal Forms in Natural Water', October 7-8, 1975, Duluth, Minn. p 77-91, April 1976. 3 fig, 5 tab, 23 ref.

Descriptors: *Zinc, *Toxicity, *Fish, *Chemical properties, Model studies, Speciation, Reviews, Atlantic salmon, Bioassay, Minnows, Rainbow trout, Sunfishes.
Identifiers: Bluegills, Fathead minnows, Goldfish, Guppies, Zebrafish, Chemical constants.

A variety of bioassay experiments defining zinc speciation and a model of zinc solubility are discussed. One extreme of the model is that all of the zinc carbonate solid phase has formed, however, the particle size is small and precipitation has not occurred. The other extreme assumes that no solid phase is formed. The literature survey indicates that there is sufficient analytical data to permit calculations of zinc speciation. The data includes pH, alkalinity, hardness (Ca and Mg), sulfate concentration and LC50 of zinc. Data is available for fathead minnows, bluegills, rainbow trout, goldfish, guppies, zebrafish and Atlantic salmon. The studies indicate that the presence of calcium and magnesium reduces the effect of zinc. An increase in pH from 6 to 8 is accompanied by a sizable reduction in zinc LC50. Usually this change is pH is accompanied by an increase in the amount of solid zinc carbonate present. It is not recommended that these acute toxicity studies be utilized for establishing zinc toxicity limits, as the precise formation of the zinc solid phase is unknown. Fish may tolerate predicted soluble zinc levels, at least for short periods, in waters of average hardness, alkalinity and pH. The toxicity of elevated zinc levels depends on the rapidity of its precipitation. (See also W77-01295) (Auen-Wisconsin)
W77-01298

STRUCTURE-ACTIVITY RELATIONS AND THE TOXICITY OF TRACE ELEMENTS TO AQUATIC BIOTA,
Atlantic Biological Station, St. Andrews (New Brunswick).
V. Zitko.
In: International Joint Commission's Workshop Proceedings 'Toxicity to Biota of Metal Forms in Natural Water', October 7-8, 1975, Duluth, Minn. p 9-32, April 1976. 2 fig, 3 tab, 60 ref.

Descriptors: *Trace elements, *Heavy metals, *Toxicity, *Molecular structure, International Joint Commission, Great Lakes, Cations, Hardness(Water), Mode of action, Environmental effects, Bonding, Cohesion, Adsorption, Chemical reactions.
Identifiers: Bioaccumulation, Detoxification.

The majority of inorganic compounds exist in the form of ions whose biological activity is a function of their binding to ionizable groups in organic compounds. Strongly bound ions block the ionizable groups and change or inhibit the normal biological functions of organic compounds. Development of binding constants to organic compounds may lead to good correlations; glycine is a good compound for correlations, and binding constants of many cations are available. The indications are that the toxicity (incipient lethal level) is a linear function of hardness and the slopes and intercepts calculated from published data are presented. The recognized toxicity reduction by organic matter may be due to the active sites in organic molecules which bind cations in the form of nontoxic complexes and an equation could be used to describe the effect of organic matter on toxicity. Competition between organic compounds and tissues to bind the toxic cations could also play a role in the toxicity-decreasing effect of organic matter. Water analyses are important for the determination of equilibrium constants which, once known, make it possible to calculate the concentrations of various ionic species and complexes and then could be expressed in 'toxic units.' (See also W77-01295) (Auen-Wisconsin)
W77-01299

METAL SPECIATION IN AQUATIC ENVIRONMENTS,
Illinois Inst. of Tech., Chicago. Dept. of Environmental Engineering.
H. E. Allen, M. L. Crosser, and T. D. Brisbin.
In: International Joint Commission's Workshop Proceedings 'Toxicity to Biota of Metal Forms in Natural Water', October 7-8, 1975, Duluth, Minn. p 33-57, April 1976. 7 fig, 21 ref.

Descriptors: *Metals, *Speciation, *Chemical properties, *Toxicity, *Analytical techniques, Ion exchange, Electrophoresis, Chemical reactions, Measurement, Electrochemistry, Equations, Chelation.
Identifiers: *Stability constants.

Measurement of the total metal concentration is insufficient to determine its biological effects as the chemical form of the metal must be known to permit accurate interpretations of both its degree of toxicity and geochemical reactions. Prediction of trace metal levels, their forms and transformations (complexations) requires the development of mechanistic models which are based on equilibrium constants of metal complexes. Recent applications of electroanalytical techniques, such as anodic stripping voltammetry, differential pulse polarography, and differential pulse anodic stripping voltammetry have been applied to the measurement of stability constants. Their applications and results are discussed. Proposed is the use of the ion exchange equilibrium technique for measurement of both stability constants and of complexation capacity; it is also useful in defining the significance of a stability constant in a multiligand system. Application of the ion exchange equilibrium to the study of a complexation in AAP medium used for toxicity studies, complexation of metals in sewage treatment plants, and assessment of the relative significance of ligands entering the aquatic environment from various sources is presented. (See also W77-01295) (Auen-Wisconsin)
W77-01300

PHARMACOKINETIC APPROACHES TO THE EVALUATION OF METHYLMERCURY IN FISH,
Michigan Univ., Ann Arbor. Public Health Toxicology Program.
R. Hartung.
In: International Joint Commission's Workshop Proceedings 'Toxicity to Biota of Metal Forms in Natural Water', October 7-8, 1975, Duluth, Minn. p. 233-248. April 1976. 6 fig., 3 tab., 8 ref.

Descriptors: *Mercury, *Fish, *Absorption, *Distribution, *Mathematical models, Persistence, Metabolism, Eels, Piles, Lake trout, Heavy metals.
Identifiers: *Methylmercury, *Mercury bioaccumulation, Methylmercury excretion.

Some of the simpler pharmacokinetic models are applied to existing data for the evaluation of the uptake of methylmercury by fish and its relationship to methylmercury environmental levels. The model cited attempts to duplicate many of the naturally occurring processes by using many compartments and rate constants. The methodology indicates that it is possible to effectively present uptake, storage, and elimination data by relatively simple kinetic equations. The model of uptake and accumulation was tested with several existing data sets and invites additional testing to explore its limitations and possible refinements. Improved precision appears possible, especially if additional information on elimination rate constants could be found for the species examined. The estimated equilibrium concentration and the theoretical bioaccumulation coefficient appear to have significant utility in comparing experimental results with one another. The data tested had been complied for pike, eel, and lake trout. Species differences with respect to uptake appear to be less significant than anticipated; however, temperature effects, possibly due to metabolic rates, were found to be pronounced and systematic. The kinetic analysis is particularly useful in permitting comparisons among bioaccumulation studies and appears to have potential for establishing an approach for relating experimental data to environmental data. (See also W77-01295) (Auen-Wisconsin)
W77-01301

MOLECULAR FORMS OF ARSENIC IN THE ENVIRONMENT,
University of South Florida, Tampa. Dept. of Chemistry.
For primary bibliographic entry see Field 5A.
W77-01302

THE MULTIPLE TOXICITY OF CERTAIN HEAVY METALS: ADDITIVE ACTIONS AND INTERACTIONS,
Concordia Univ., Montreal (Quebec). Dept. of Biological Sciences.
P. D. Anderson, and L. J. Weber.
In: International Joint Commission's Workshop Proceedings 'Toxicity to Biota of Metal Forms in Natural Water', October 7-8, 1975, Duluth, Minn. p. 263-282, April 1976. 7 fig., 5 tab., 17 ref.

Descriptors: *Heavy metals, *Toxicity, *Mixing, *Organic compounds, Chemical reactions, Mode of action, Measurement, Mathematical models, Copper, Zinc, Nickel, Chlorinated hydrocarbon pesticides, Potassium compounds, Dieldrin.
Identifiers: *Synergistic effects, *Antagonistic effects, *Additive effects, Guppies, Toxic units, Potassium pentachlorophenate, Potassium cyanide.

Results of studies conducted with chloride salts of copper, nickel, zinc, and HEOD--a chlorinated hydrocarbon pesticide (Dieldrin), potassium pentachlorophenate (KRCP) and potassium cyanide (KCN) to determine their additive, synergistic or antagonistic effects on guppies are described. This approach for studying multiple toxicity may provide an adequate method for (1) identification of both similar-acting toxicants and synergistic toxicants and (2) the prediction of the mixture's toxicity. The organic compounds acted independently not only in relation to each other in a binary mixture but also in the presence of heavy metals in a quarternary mixture. Nevertheless, assumptions may be drawn that the lethal action of dieldrin and KPCP were not altered by the presence of high concentrations of heavy metals or vice versa. However not all organic compounds act synergistically, antagonistically or by strict addition. Furthermore certain organic toxicants may act as chelating agents which effectively remove the toxic forms of heavy metals. The apparent demonstration in these studies of independently acting toxicants as constituents of a mixture support the Toxic Unit principle, i.e., that safe levels established for individual toxicats will also provide an adequate safeguard against mixtures. The sublethal effects of these toxicants were not investigated. (See also W77-01295) (Auen-Wisconsin)
W77-01303

TOXICITY RELATIONSHIPS TO COPPER FORMS IN NATURAL WATERS,
Environmental Research Lab., Duluth, Minn.
R. W. Andrew.
In: International Joint Commission's Workshop Proceedings 'Toxicity to Biota of Metal Forms in Natural Water', October 7-8, 1975, Duluth, Minn. p. 127-143. April 1976. 4 fig., 5 tab., 22 ref.

Descriptors: *Copper, *Toxicity, *Chemical properties, Water chemistry, Minnows, Daphnia, Hydrogen ion concentration, Heavy metals, Solubility, Chelation, Bioassay, Fish, Waterfleas, Consolidation.
Identifiers: *Cupric ion, Fathead minnow.

Tests with fathead minnows and Daphnia magna demonstrated that copper toxicity is largely a function of the cupric ion activity and that toxicity variations primarily occur as a result of changes in ionic activity either through precipitation or complexation. Copper precipitation as hydroxides, carbonates, and/or phosphates results in toxicity reductions. In highly alkaline waters with a minimum of soluble complexing or chelating agents, measurements of dissolved copper may give a fair approximation of the biologically active form with attendant reduction in the toxicity variance. LC50 values based on total copper measurements in such situations were totally irreproducible and have little value even as an indicator of relative toxicity. None of the soluble (dissolved) complexes or chelated forms, including organic and inorganic complexes and neutral and ionized forms, are appreciably toxic. Toxicity of the cupric ion may be modified by interaction with other cations, particularly hydrogen ions. Calcium and magnesium do not appear to be a major factor in copper toxicity. Both bicarbonate alkalinity and orthophosphate have major roles in limiting copper toxicity; however cupric ion toxic levels can be accurately measured and/or monitored in flow-through bioassays. Increasing toxicity of cupric ion at high pH is hypothesized to result from interactions with sulfhydryl-containing proteins or enzymes. (See also W77-01295) (Auen-Wisconsin)
W77-01304

THE NEED TO ESTABLISH HEAVY METAL STANDARDS ON THE BASIS OF DISSOLVED METALS,
Colorado Div. of Wildlife, Fort Collins. Research Center.
For primary bibliographic entry see Field 5A.
W77-01305

ASPECTS OF HEAVY METALS TOXICITY IN FRESH WATERS,
Water Pollution Research Centre Stevenage (England).
V. M. Brown.
In: International Joint Commission's Workshop Proceedings 'Toxicity to Biota of Metal Forms in Natural Water', October 7-8, 1975, Duluth, Minn. p. 59-75, April 1976. 2 tab., 35 ref.

Descriptors: *Heavy metals, *Toxicity, *Speciation, Aquatic animals, Fish, Solubility, Absorption, Trace elements, Stability, Suspended solids, Ions, Hydrogen ion concentration, Hardness(Water), Calcium carbonate, Cadmium, Copper, Zinc, Consolidation, Chromium, Nickel.
Identifiers: *Toxicology, Synergistic effects, Antagonistic effects.

The problems involved in the determination of the toxicity of the chemical components of heavy metals, their synergistic/antagonistic effects with other metal chemials, the pH, water hardness, and suspended solids, are discussed. Tests of single substances and single species (often only acute lethal tests) to define 'acceptable' levels are invalid determinations of toxic levels particularly under chronic exposure or fluctuating concentrations. When it comes to assessing the effects of variously mixed effluents, it is impossible to fully describe their chemical components let alone their effects; and even if these effects were identifiable, their biological effects would still be unpredictable. Included in this presentation are the types of heavy metal contaminations, basic aspects of their toxicology to animals (particularly fishes), and some of the work on the toxic aspects of the chemical states of copper, cadmium, zinc, chromium, nickel, and their interactions with suspended solids and chelating compounds. One conclusion is that because in hard waters chemical availability of the cupric ion tends to limit toxic concentrations whereas in soft waters it is the physiological aspects of fishes and of the non-specificity of both heavy metals and ligands, it is unlikely that precise definitions of toxic relations are possible. (See also W77-01295) (Auen-Wisconsin).
W77-01306

COPPER TOXICITY TO PHYTOPLANKTON, AS AFFECTED BY ORGANIC LIGANDS, OTHER CATIONS AND INHERENT TOLERANCE OF ALGAE TO COPPER,
Toronto Univ. (Ontario). Inst. for Environmental Studies and Engineering.
P. Stokes, and T. C. Hutchinson.
In: International Joint Commission's Workshop Proceedings 'Toxicity to Biota of Metal Forms in Natural Water', October 7-8, 1975, Duluth, Minn. p. 159-185, April 1976. 14 fig., 3 tab., 26 ref.

Descriptors: *Copper, *Toxicity, *Plant physiology, *Resistance, *Algae, Organic matter, Cations, Heavy metals, Ions, *Canada, Nickel, Chlorella, Scenedesmus, Chelation, Absorption.
Identifiers: Sudbury(Ontario), Metals tolerance.

In addition to the speciation of metal and metal movement through aquatic ecosystems, toxicity is dependent on the physiological processes of the organisms themselves. The effect of the chemistry of a particular metal on an organism is mediated by the effect of pH and cations. The organisms complete with non-living parts of the system as binding sites consequently the actual thresholds of toxicity even for closely related biota vary widely. Field and laboratory studies attempted to relate the toxicity of the form and concentration of heavy metals to algae (Scenedesmus and Chlorella), particularly of 'labile' and 'bound' metals to the relationship between chemical measurements and metal toxicity. The field sites centered around the Sudbury, Ontario, mining and smelting region where some lakes have been recorded to contain 6.4 ppm levels of nickel and 1.0 ppm of copper. Five lakes were selected with varying organic and heavy metal contents, and with a pH higher than 6.0. It was found that copper tolerance has evolved in some of the algae. The major difference in algal response could be accounted for by differences in organic matter and by their relative complexing capacity. The test information generated has little direct application but does have potential for a number of chemical and biological assays for water quality determinations. (See also W77-01295) (Auen-Wisconsin)
W77-01307

POTENTIAL ROLES OF METAL-LIGANDS IN THE MARINE ENVIRONMENT,
Environmental Research Lab., Narragansett, R. I.
For primary bibliographic entry see Field 5B.
W77-01308

EFFECTS OF ORGANIC POLLUTANTS ON COPPER TOXICITY TO FISH,
Michigan Univ., Ann Arbor. Dept. of Environmental and Industrial Health.
D. P. Chynoweth, J. A. Black, and K. H. Mancy.
In: International Joint Commission's Workshop Proceedings 'Toxicity to Biota of Metal Forms in Natural Water', October 7-8, 1975, Duluth, Minn. p. 145-157, April 1976. 5 tab., 31 ref. FWPCA 14-12-591.

Guppies were exposed to copper at 50-500 microgram/l concentrations in the presence of various organic ligands in moderately hard water (66.8-98.0 mg/l calcium carbonate) maintained at pH 7.5. The organic compounds were selected on the basis of their prevalence as pollutants or their complexing properties. Glycine, cysteine, EDTA, NTA, and citric acid were added at concentrations of 0.0000036 M. Albumin, humic acid, and secondary sewage effluent were added to give a final concentration of 5 mg/l (as total organic matter). Median lethal copper doses were calculated using log probit analyses of the bioassay data. The relative binding capacities of the organic ligands were determined by anodic stripping voltammetry. The toxicity results were compared to the stability of the copper-organic complexes in the bioassay solutions. Test fish were analyzed by atomic absorption spectrophotometry to determine the amount of copper accumulation in the internal organs. An inverse relationship was observed between the degree of copper binding and copper toxicity. No significant correlation was obtained between organic binding or toxicity and uptake of copper by fish. Unresolved are the effects of alkalinity and hardness on copper toxicity; toxicity of copper complexed with inorganic and organic particulates; toxicity of copper contained in fish food; and sites and mechanisms of copper toxicity. (See also W77-01295) (Auen-Wisconsin)
W77-01309

SYMPOSIUM ON STRUCTURE-ACTIVITY CORRELATIONS IN STUDIES OF TOXICITY AND BIOCONCENTRATION WITH AQUATIC ORGANISMS.
International Joint Commission-United States and Canada.
March 11-13, 1975, Canada Center for Inland Waters, Burlington, Ontario. 352 p. G. D. Veith and D. E. Konasewich, editors.

Descriptors: *Chemicals, *Molecular structure, *Toxicity, Sorption, Solubility, Organic compounds, Testing, Food chains, Osmosis, Surfactants, Linear alkylate sulfonates, Lethanl limit, Daphnia, Minnows, International Joint Commission, Phenols, Analytical techniques, Bioassay, Fish, Animal pathology, Mode of action, Rainbow trout, Pesticides, Persistence, Measurement, Penetration, Chemical reactions, Solutes, Pollutants, Mathematical models, Correlation analysis, Permits, Standards, Distribution, Pollutant identification.
Identifiers: Bioconcentration, Toxic units, Combined toxicants, Synergism, Antagonism, Multivariate analysis, Partition coefficients, Depuration, Biological half-life, Sub-lethal effects, Toxicology.

The contributions centered on the structure of chemicals as they relate to toxicity and biomagnification/bioaccumulation with the underlying thrust of further research requirements. Papers discussed the structure-activity relationships in toxicology of fish and Daphnia; surfactant, phenolic compounds, and DDT analogs and their toxicity, uptake, depuration; and intertissue movement of hydrophilic, amphiphilic, and hydrophobic compounds as related to fat solubility. Presentations discussed the use of the n-octanol/water partition coefficient in predicting the bioconcentration potential of organic chemicals, and its use in the evaluation of the relative hazards of various chemicals. Other papers related to the comparison of analytical methods in the relationship between chemical and biological properties of chemicals; utilization of available environmental data for toxicity studies; the study of multiple toxicity; and mathematical models for the time/space distribution of chemicals in water. Also, details are given for a permit system to control chemical pollution based on a toxicity index. A panel discussion followed the presentations, generating the conclusions that structure-activity correlations can be successfully applied to toxicity testing by using the n-octanol/water partition coefficient, the Hammet sigma constant, the field and resonance constants and the pK. The correlations can be applied to structurally related chemicals exhibiting the same mode of action and the same biological endpoint. The correlations are not likely to predict the toxicity of complex effluents. The chemical uptake rates significantly affect the death rate in acute toxicity tests. (See W77-01311 thru W77-01322) (Auen-Wisconsin)

W77-01310

SURFACTANT STRUCTURE AND AQUATIC TOXICITY,
Monsanto Chemical Co., St. Louis, Mo.
For primary bibliographic entry see Field 5A.
W77-01311

PREDICTING A BIOCONCENTRATION POTENTIAL OF ORGANIC CHEMICALS IN FISH FROM PARTITION COEFFICIENTS,
Dow Chemical Co., Midland, Mich.
D. R. Branson, W. B. Neely, and G. E. Blau.
In: International Joint Commission Symposium on 'Structure-Activity Correlations in Studies of Toxicity and Bioconcentration with Aquatic Organisms,' March 11-13, 1975, Canada Center for Inland Waters, Burlington, Ontario, p 99-118. 2 fig, 5 tab, 13 ref.

Descriptors: *Chemicals, *Absorption, *Measurement, Food chains, Rainbow trout, Organic compounds, Toxicity, Osmosis.
Identifiers: *Bioconcentration, Partition coefficient.

The ratio of the equilibrium concentration of a chemical between a nonpolar and polar solvent (in this instance n-octanol and water), i.e., the partition coefficient, was used to examine the relationship between the physiochemical properties of chemicals and their ability to bioconcentrate. The chemicals with a wide range of partition coefficients, included 1,1,2,2-tetrachloroethylene, hexachlorobenzene, 2,2',4,4'-tetrachlorobiphenyl, 2-biphenyl phenyl ether, diphenyl ether, carbon tetrachloride, and p-dichlorobenze. The relationship was established by measuring the bioconcentration (the ratio of the concentration of the chemical between trout muscle and the exposure water measured at equilibrium) in trout. The following equation of the straight line can best be used to predict the bioconcentration of chemicals from their partition coefficients: Log (Bioconcentration factor) = 0.542 Log (Partition coefficient) + 0.124. The predicted values for biomagnification apply to a specific test procedure and have been used primarily to compare various new chemicals. In interpreting the bioconcentration factor for any chemical it must be remembered that metabolism for the agent may be a very active process, consequently the total amount of material in the ecosystem is constantly being reduced while the ratio between the fish and the environment will remain relatively fixed. (See also W77-01310) (Auen-Wisconsin)
W77-01312

STRUCTURE-ACTIVITY RELATIONSHIPS IN FISH TOXICOLOGY,
Fisheries and Marine Service, St. Andrews (New Brunswick). Biological Station.
V. Zitko.
In: International Joint Commission Symposium on 'Structure-Activity Correlations in Studies of Toxicity and Bioconcentration with Aquatic Organisms,' March 11-13, 1975, Canada Center for Inland Waters, Burlington, Ontario, p 7-24. 25 ref.

Descriptors: *Toxicity, *Chemicals, *Molecular structure, *Testing, Solubility, Organic compounds, Aquatic animals, Fish, Sorption, Food chains, Osmosis.
Identifiers: Bioconcentration, Hansch method, Toxicology.

A review of the quantitative relationships between the chemical structure and properties of organic molecules, and biological activity indicates that these relationships are a useful tool in aquatic toxicology. Correlations between the h ophobic (lipophilic) character of small, mostly ectrically neutral molecules, and their toxicity o aquatic fauna are available and are shown as equations. While substituted salicylanilides are probably the largest group of related compounds examined for fish toxicity, the data have not been quantitatively valuated in terms of free-energy related constants. The availability of numerous chlorobiphenyls makes them an attractive group for structure-activity correlation although fish metabolize most chlorobiphenyls very slowly, if at all. Aromatic and aliphatic hydrocarbons are also suitable for structure-activity correlations, as fish metabolize these compounds and shellfish accumulate them. Logically, compounds above a certain molecular weight will not be taken up by aquatic animals, but it would be of interest to determine if any generalizations on uptake-molecular weight relationships can be made. Also low water solubility compounds may not be available to fauna and this area is another subject for investigation. Determination of structure-activity relationships will supply answers about environmental effects of organic compounds but their major limitation is the choice of appropriate types of biological activity. (See also W77-01310) (Auen-Wisconsin)
W77-01313

STRUCTURE-ACTIVITY RELATIONSHIPS APPLIED,
Minnesota Univ., Duluth. Dept. of Chemistry.
R. M. Carlson, H. L. Kopperman, R. Caple, and R. E. Carlson.
In: International Joint Commission Symposium on 'Structure-Activity Correlations in Studies of Toxicity and Bioconcentration with Aquatic Organisms,' March 11-13, 1975, Canada Center for Inland Waters, Burlington, Ontario, p 57-72. 2 fig, 3 tab, 32 ref. 18050 Hik and R800675.

Descriptors: *Toxicity, *Phenols, *Analytical techniques, Daphnia, Lethal limit, Chromatography, Solubility, Sorption, Food chains, Osmosis.
Identifiers: Partition coefficient, Hansch method, Bioconcentration.

A correlation showing the dependency of the observed lethal limit-50 of a series of phenols to the free energy related terms, pi, field and resonance (F and R), has been observed for the freshwater invertebrate, Daphnia magna. A series of 14 phenols wi s investigated with the best correlation obtained with F and R considered to be additive terms, as shown in the following equation: Log 1/c = 0.500pi plus 0.453F plus 0.63R plus 3.73. r = 0.978. Moreover, the dominant parameter was found to be the partition coefficient, represented by the equation: Log 1/c = 0.527pi plus 3.796 r = 0.831. The implications of these results to toxicity and bioaccumulation has led to the development of a method using a permanently bonded long chain alkyl packing in a high pressure liquid chromatographic system and subsequently relating the capacity factor--the net retention time relative to the nonadsorbed time--to the partition coefficient. (See also W77-01310) (Auen-Wisconsin)
W77-01314

STRUCTURE-ACTIVITY RELATIONSHIPS OF DDT ANALOGS IN A NON-TARGET ORGANISM. LETHAL AND SUBLETHAL EFFECTS OF BROOK TROUT FINGERLINGS,
Carleton Univ., Ottawa (Ontario). Dept. of Biology.
D. R. Gardner.
In: International Joint Commission Symposium on 'Structure-Activity Correlations in Studies of Toxicity and Bioconcentration with Aquatic Organisms,' March 11-13, 1975, Canada Center for Inland Waters, Burlington, Ontario, p. 77-97. 8 fig., 18 ref.

Descriptors: *Chemicals, *Molecular structure, *Toxicity, *Mode of action, Lethal limit, Bioassay, Fish, Environmental effects, Animal pathology.
Identifiers: Sub-lethal effects.

The problems of determination of the mechanism and/or site of action of a particular chemical compound by comparison of in vitro and in vivo molecular requirements for toxicity, to provide data on receptor site specificity, and prediction of the toxicity of compounds by examination of their molecular structure and properties are discussed. The experimental design attempted to define what biological parameters should be considered for structure-activity relationships, what can be examined with any degree of accuracy, what significance do chosen parameters have to the survival of the whole animal, how to relate an in vitro approach to in vivo, how to confront the biological material with known concentrations of a compound, and, finally how to assess the significance of the effects of compounds at sublethal doses. The examination centered on the effect of ten DDT analogs on brook trout fingerlings, i.e., the relationship between a molecule of known pesticide properties and a nontarget organism, using their response to temperature gradients. The conclusions underscore the necessity for choosing appropriate biological parameters as measures of structure-activity relationships. Also the necessity for considering that the sublethal effect on target and on non-target organisms, or non-toxic compounds, might eventually produce a delayed mortality. (See also W77-01310) (Auen-Wisconsin)
W77-01315

STATISTICAL PROPERTIES OF ENVIRONMENTAL DATA: CONSIDERATIONS FOR BIOACCUMULATION AND TOXICITY STUDIES OF POLLUTANTS,
Illinois State Environmental Protection Agency, Springfield.
D. J. Schaeffer, and K. G. Janardan.
In: International Joint Commission Symposium on 'Structure-Activity Correlations in Studies of Toxicity and Bioconcentration with Aquatic Organisms,' March 11-13, 1975, Canada Center for Inland Waters, Burlington, Ontario, p. 177-194. 1 fig., 2 tab., 22 ref.

Descriptors: *Pollutants, *Toxicity, *Mathematical models, *Data collections, Statistical methods, Analytical techniques, Food chains, Correlation analysis.
Identifiers: *Bioconcentration, Data analysis, Multivariate analysis.

The usage of existing environmental data in toxicity studies and some statistical properties of such data are examined, and a technique is described for estimating the relative magnitudes of analytical laboratory and sampling errors. In many instances these estimates are more than adequate for devising better collection programs; at the very least they provide a priori information estimates which can be used in Bayesian statistical analyses to obtain precise posterior estimates. The evaluation of the significance of data must include the validity of experimental protocol, the reliability of the tests used to make the measurements, the quality of the answers obtained from the data analysis and their relation to the original questions, and the significance of the conclusions. The point made is that the establishment of structure-activity relationships does not necessarily indicate that the molecular properties and the toxic responses are related by a cause and effect relationship to these parameters, but only that these parameters have a high degree of usefulness in the mathematical discrimination of these properties as they pertain to a data set. The Murkov-Polya Urn Models theory is applied to the development of a model of pollutant-induced stress on biological communities. (See also W77-01310) (Auen-Wisconsin)
W77-01316

MATHEMATICAL MODELS TO DESCRIBE THE TIME/SPACE DISTRIBUTION OF CHEMICALS IN A WATER SYSTEM,
Dow Chemical U.S.A., Midland, Mich. Functional Products and Systems.
For primary bibliographic entry see Field 5B.

W77-01317

AN APPROACH TO THE STUDY OF MULTIPLE TOXICITY,
Sir George Williams Univ., Montreal (Quebec). Dept. of Biological Sciences.
P. D. Anderson.
In: International Joint Commission Symposium on 'Structure-Activity Correlations in Studies of Toxicity and Bioconcentration with Aquatic Organisms,' March 11-13, 1975, Canada Center for Inland Waters, Burlington, Ontario, p. 195-198.

Descriptors: *Toxicity, *Pollutants, *Mode of action, Chemical reactions.
Identifiers: *Combined toxicants, *Synergism, *Antagonism.

A rationale for models to predict the toxicity of mixtures through the derivation and use of quantal (all or none) response curves of the toxic constituents is proposed. The rationale assumes three principal categories of toxic action between discrete chemical constituents of a mixture, i.e., independent action, additive action, and interaction (synergism and antagonism). Independent action is predictable on the axiom that the kinetic and dynamic mechanisms of each toxic element are unique and are not influenced by any other chemical components in the mixture. The additive action is predictable on the assumption that the dynamic mechanism is common to or similar for all toxic constituents; individual toxic components may differ in their relative potencies or efficacies but act identically on the target tissue. Consequently the quantal response curves for each constituent as well as their corresponding mixture should be parallel. The interaction of toxic mixtures assumes that the kinetics and/or dynamics of a toxic constituent are altered in the presence of another toxicant, and the relative potency of a toxicant may be either enhanced or lessened in the mixture. The magnitude of the response to a mixture in which the components interact is dependent on the relative proportions of the constituents rather than on their inherent potencies. (See also W77-01310) (Auen-Wisconsin)
W77-01318

A COMPARISON OF METHODS FOR THE ANALYSIS OF THE RELATIONSHIP BETWEEN CHEMICAL AND BIOLOGICAL PROPERTIES OF CHEMICALS,
Abbott Labs., North Chicago, Ill.
For primary bibliographic entry see Field 5A.
W77-01319

BIOCONCENTRATION OF 14C-PESTICIDES BY BLUEGILL SUNFISH DURING CONTINUOUS AQUEOUS EXPOSURE,
Bionomics, Inc., Wareham, Mass.
K. J. Macek, M. E. Barrows, R. F. Frasny, and B. H. Sleight.
In: International Joint Commission Symposium on 'Structure-Activity Correlations in Studies of Toxicity and Bioconcentration with Aquatic Organisms', March 11-13, 1975, Canada Center for Inland Waters, Burlington, Ontario, p. 119-142. 5 fig., 6 tab., 12 ref.

Descriptors: *Food chains, *Pesticides, *Persistence, Chemicals, Osmosis, Carbon radioisotopes.
Identifiers: *Bioconcentration, Depuration, Biological half-life.

Experimental results of the propensity of over 50 C14 labeled pesticides to accumulate in bluegill, bioconcentration factors, and measures of the fishes depuration upon transfer to uncontaminated water are presented. These data are compared to similar parameters generated for certain chemicals generally considered hazardous to aquatic ecosystems. A number of general observations relating to the time to establish equilibrium, the bioconcentration factor obtained, the estimated biological half-life, and the effect of the pesticide concentration on these parameters are summarized. For a great majority of the labeled pesticides, an equilibrium was reached in less than three weeks and for most pesticides, the chemical residues in the muscle of bluegill are relative short-lived provided contamination is not continuous or the exposure prolonged. Biological half-life of more than two-thirds of the labeled pesticides was less than seven days. A model ecosystem approach was also utilized for a more realistic assessment of the potential hazard for food chain contamination. The bioconcentration of 14C-residues in bluegill exposed to the same herbicide in both the fish-water system and the model ecosystem differed dramatically; this was primarily due to conversion during the aging period in the model system of the parent 14C-herbicide to 14C-degradation products with much lower propensities to accumulate and persist. (See also W77-01310) (Auen-Wisconsin)
W77-01320

TOXICITY INDEX FOR PERMITS,
National Field Investigations Center-Denver, Colo.
For primary bibliographic entry see Field 5A.
W77-01321

CALCULATION OF PARTITION COEFFICIENTS USEFUL IN THE EVALUATION OF THE RELATIVE HAZARDS OF VARIOUS CHEMICALS IN THE ENVIRONMENT,
Pomona Coll. Claremont, Calif. Dept. of Chemistry.
A. J. Leo.
In: International Joint Commission Symposium on 'Structure-Activity Correlations in Studies of Toxicity and Bioconcentration with Aquatic Organisms,' March 11-13, 1975, Canada Center for Inland Waters, Burlington, Ontario, p. 151-176. 15 fig.

Descriptors: *Chemicals, *Toxicity, *Measurement, Solubility, Molecular structure, Penetration, Chemical reactions, Solutes, Osmosis.
Identifiers: *Partition coefficients.

The partition coefficient, P, measures the energy involved in transferring a molecule of a solute from water to a non-polar solvent and is an essential parameter in the study of the effect of potentially toxic chemicals in water. The distribution of a solute between immiscible solvents--water and octanol--can be treated as though it results from three primary factors: (1) the energy required for 'hole' formation, (2) the solute-solvent interaction from permanent bond dipoles; and, (3) the solute-solvent interaction from hydrogen bonds. As these three factors operate in both octanol and water, thus it is the sum of the relative effect which determine the equilibrium between phases, i.e., the partition coefficient. Not only is the bioaccumulation factor related to the log P of the chemical, but frequently its activity within the organisms--disruption of key enzymatic processes or its metabolic fate--is log P dependent. When a high degree of confidence can be overlooked, calculated log Ps can serve very well if developed from measured values for molecular structures which contain the important 'interactive' fragments. The theoretical basis for such calculations and the significance of the differences in values from various lipid solvent systems are discussed and illustrated. (See also W77-01310) (Auen-Wisconsin)
W77-01322

A PRELIMINARY TROPHIC STATUS CLASSIFICATION OF SOME SOUTH AFRICAN IMPOUNDMENTS,
National Inst. for Water Research, Pretoria (South Africa).
D. F. Toerien, K. L. Hyman, and M. J. Bruwer.
Water SA., Vol 1 (1), p 15-23, (1975). 3 fig, 4 tab, 11 ref.

Descriptors: Water quality, Bioassay, *Algae, Nutrients, Nitrogen fixation, *Eutrophication, Phosphorus, Impoundments, Africa, *Trophic level, Classification, Algal control.
Identifiers: *South Africa, Limiting nutrients, *Algal growth.

A preliminary trophic status classification of 98 major South African impoundments was constructed using agal bioassay procedures to determine the algal growth potential and to identify the growth limiting nutrients in each impoundment. The classification procedure embodied a technique whereby the growth potential of nitrogen fixing algae was accounted for. Phosphorus was the most frequent algal growth limiting nutrient in non-eutrophied impoundments and nitrogen the most frequent in highly eutrophied ones. Because of the fixation of atmospheric nitrogen by certain blue-green algae, the control of nitrogen appears to have limited value in eutrophication control. Limiting the access of phosphorus to impoundments seems to offer a long-term solution to eutrophication problems. Urban-industrial development, giving rise to nutrient rich effluents, seems to be the major cause of eutrophication although the role of agriculture can not be negated. (South Africa)
W77-01363

THE EUTROPHICATION LEVELS OF SOME SOUTH AFRICAN IMPOUNDMENTS. 1. RIETVLEI DAM,
National Inst. for Water Research, Pretoria (South Africa).
D. J. Steyn, W. E. Scott, D. F. Toerien, and J. H. Visser.
Water SA, Vol 1 (2), p 45-52, (1975). 9 fig, 4 tab, 12 ref.

Descriptors: Water pollution effects, *Bioassay, Sewage effluents, Phosphorus, Algae, Seasonal, Nutrients, *Eutrophication, Pollutant identification, Impoundments, Africa.
Identifiers: *Rietvlei Dam(South Africa), Limiting nutrients.

Algal bioassay results show Rietvlei Dam to be in a highly eutrophied state. The growth of non-nitrogen-fixing algae is limited by nitrogen, and that of nitrogen-fixing algae by phosphorus. It is predicted that increased discharge of sewage works effluent will increase the eutrophication status of the dam, but an inflow with lower nutrient concentrations will reduce it. The results suggest that the control of phosphorus rather than nitrogen inputs must be considered for eutrophication control, but a more complete understanding of the chemical, physical and biological characteristics of the impoundment is required before a decision can be made as to the best methods of eutrophication control. (See also W77-01392) (South Africa)
W77-01391

EUTROPHICATION LEVELS OF SOME SOUTH AFRICAN IMPOUNDMENTS. II. HARTBEESPOORT DAM,
National Inst. for Water Research, Pretoria (South Africa).
D. J. Steyn, D. F. Toerien, and J. H. Visser.
Water S. A. Vol. 1 (3), p 93-101 (1975). 7 fig, 3 tab, 22 ref.

Descriptors: *Eutrophication, *Bioassay, Nutrients, Nitrogen, Phosphorus, Sewage effluents, Algae, Dams, Impoundments, Africa, Water pollution effects, Pollutant identification.
Identifiers: *South Africa, *Hartbeespoort Dam(So Africa), Limiting nitrients.

Algas bioassays indicated that Hartbeespoort Dam is highly eutrophied because algal growth poten-

tials (AGP) of more than 100 mg l-1 and batch culture algal growth rates of 2, 1 d-1 were recorded. Nitrogen was the primary and phosphorus the secondary growth-limiting nutrient. Addition of secondary sewage effluents linearly increased the AGP at rates of between 7,7 and 13,0 mg l-1 per cent (v/v) effluent added. These increases could be attributed to an increase in the nitrogen content of the water by the effluent. Addition of sewage effluents did not change the identity of nitrogen as the primary growth-limiting nutrient. Dilution with water of a low nutrient content linearly decreased the AGP. Although nitrogen at present determines the magnitude of algal blooms in the dam, phosphorus control is advocated for the control of eutrophication problems in the dam. (See also W77-01391) (South Africa)
W77-01392

LIMNOLOGICAL DATA REPORT FOR THE MAINE DEPARTMENT OF ENVIRONMENTAL PROTECTION--U. S. GEOLOGICAL SURVEY COOPERATIVE LAKE STUDIES PROJECT,
Geological Survey, Augusta, Maine.
For primary bibliographic entry see Field 2H.
W77-01414

THE BENTHOS OF SOME SOUTHERN AFRICAN LAKES PART 3: THE BENTHIC FAUNA OF LAKE NHLANGE, KWAZULU, SOUTH AFRICA,
Rhodes Univ., Grahamstown (South Africa). Dept. of Zoology and Entomology; and Rhodes Univ., Grahamstown (South Africa). Inst. of Freshwater Studies.
For primary bibliographic entry see Field 2H.
W77-01437

THE BENTHOS OF SOME SOUTHERN AFRICAN LAKES PART 4: THE BENTHOS OF LAGOA POELELA,
Rhodes Univ., Grahamstown (South Africa). Dept. of Zoology and Entomology; and Rhodes Univ., Grahamstown (South Africa). Inst. of Freshwater Studies.
For primary bibliographic entry see Field 2H.
W77-01438

THE BENTHOS OF SOME SOUTHERN AFRICAN LAKES PART 5: THE RECOVERY OF THE BENTHIC FAUNA OF ST LUCIA LAKE FOLLOWING A PERIOD OF EXCESSIVELY HIGH SALINITY,
Rhodes Univ., Grahamstown (South Africa). Dept. of Zoology and Entomology; and Rhodes Univ., Grahamstown (South Africa). Inst. of Freshwater Studies.
For primary bibliographic entry see Field 2H.
W77-01439

ENRICHMENT WILL MAKE US POORER, (VERRYKKING GAAN ONS ARMER MAAK),
National Inst. for Water Research, Pretoria, (South Africa).
For primary bibliographic entry see Field 5G.
W77-01456

ENERGY DISPERSIVE X-RAY ANALYSIS (EDAX) AS AN AUTOPSY TECHNIQUE FOR COPPER-CAUSED FISH MORTALITY,
National Inst. for Water Research, Pretoria (South Africa).
For primary bibliographic entry see Field 5A.
W77-01460

COMPILATION OF STATE DATA FOR EIGHT SELECTED TOXIC SUBSTANCES, VOL. III, ANNOTATED BIBLIOGRAPHY OF STATE DATA AND INFORMATION SOURCES,
Mitre Corp., McLean, Va.
For primary bibliographic entry see Field 5A.
W77-01494

METHANE, CARBON DIOXIDE, AND DISSOLVED SULFATE FROM INTERSTITIAL WATER OF COASTAL MARSH SEDIMENTS,
Louisiana State Univ., Baton Rouge. Coastal Studies Inst.
For primary bibliographic entry see Field 5B.
W77-01495

ACTION OF THREE PRESUMABLY ETOCRINE SUBSTANCES (RIBOFLAVIN, GLUTAMIC ACID, GLYCINE) ON THE KINETICS OF EGG DEVELOPMENT AND LARVAL GROWTH IN TWO SPECIES OF ECHINOIDS, ARBACA LIXULA AND PARACENTROTUS LIVIDUS). ACTION DE TROIS SUBSTANCES SUPPOSEES ECTOCRINES (RIBOFLAVINE, ACIDE GLUTAMIQUE, GLYCINE) SUR LA CINETIQUE DU DEVELOPPEMENT DE L'OUEF ET AL ROISSANCE DE LA LARVE DE DEUX ESPECES D'ECHIINIDES, ARBACIA LIXULA ET PARACENTROTUS LIVIDUS,
Institut Oceanographique, Paris (France).
J. F. Pacillon.
Marine Biology, Vol. 34, p. 67-75, 1976. 1 tab., 5 fig., 16 ref.

Descriptors: *Inhibitors, Mode of Action, *Immature growth stage, *Growth rates, *Amino acids, Larvae, *Larval growth stage, Kinetics, Biochemistry, *Vitamins, *Nutrients, Enzymes, Animal physiology, Vitamin B, Laboratory tests.
Identifiers: Riboflavin, Glutamic acid, Glycine, *Arbacia lixula, *Paracentrotus(Lividus), Echinoids, Etocrine substances.

The kinetics of egg development and larval growth of the 48-hr Arbacia lixula pluteus and Paracentrotus lividus were compared in sea water and in media containing concentrations of riboflavin, glutamic acid and glycine from 0.1 microgram/l to 50 mg/l. Glutamic acid and glycine appear to significantly effect both egg and larval development and riboflavin appears to effect development in the egg only. Dissolved amino-acids tested at natural concentrations interfere in protein synthesis according to the degree of maturity of the eggs and the species. This action modifies the kinetics of the development of the egg and larval growth. Riboflavin appears to stimulate enzyme action which has no deleterious effect on pluteus growth. In high concentrations, the amino-acids could act as chelates indirectly stimulating the growth of the larva. (Katz)
W77-01496

EFFECT OF SOME PESTICIDES ON THE ABILITY OF THE FILTERATION OF EEL CULTURE USING RECIRCULATING FILTER SYSTEM, (IN KOREAN),
Pusan Fisheries Coll. (Republic of Korea).
I.-B. Kim, and M. J. Park.
Bull Korean Fish Soc. 7(4), p 187-194, 1974.

Descriptors: *Pesticides, *Fish diseases, Control, *Cultural control, *Filters, Eels, Water pollution effects.
Identifiers: Formalin, Malachite green, Dipterex, Furanace.

When rearing fish in recirculating filter systems, some pesticides are often used for controlling various fish diseases. The pesticides are usually applied after stopping the filtration, to avoid affecting the filtering ability to bacteria in the filter system. The influence of 3 pesticide treatments: formalin, 33 ppm plus malachite green, 0.15 ppm; Dipterwx, 0.25 ppm; and furanace, 0.1 ppm, on filtering ability, expressed as the consumption rate of dissolved O2 and depletion of NH3-N during passage through the filter layer was investigated. These pesticides did not affect filtering ability.--Copyright 1975, Biological Abstracts, Inc.
W77-01497

PHYTOPLANKTON DIVERSITY AHD CHLOROPHYLL-A IN A POLLUTED ESTUARY,
Montclair State Coll. Upper Montclair, N. J. Dept. of Biology.
M. J. McCormick, and P. T. Quinn.
Marine Pollution Bulletin, Vol. 6, No. 7, p. 105-106, July, 1975. 2 fig., 1 tab., 6 ref.

Descriptors: *Phytoplankton, *Chlorophyll, *Primary productivity, *Biomass, Population, *Eutrophication, *Nannoplankton, Plankton, Water quality, Aquatic algae, Estuaries, Analytical techniques, *New Jersey.
Identifiers: *Newark Bay(NJ), *Diversity(Phytoplankton).

The quantity of phytoplankton in Newark Bay, New Jersey as indicated by chlorophyll-a content of the water, is low in the winter and early spring, and fluctuates greatly during the spring and summer. Chlorophyll-a concentrations are generally less than 20 micrograms/liter until April. Between April and August, three phytoplankton blooms were indicated by chlorophyll-a concentrations as high as 81.4 micrograms/liter. Net phytoplankton diversity values indicated generally eutrophic conditions; however, there was no significant correlation between diversity and chlorophyll-a concentrations. A role of nannoplankton in blooms is indicated. (Katz)
W77-01499

SHELL DISEASE IN CRABS AND LOBSTERS FROM NEW YORK BIGHT,
National Marine Fisheries Service, Highlands, N. J. Sandy Hook Lab.
J. S. Young, and J. B. Pearce.
Marine Pollution Bulletin, Vol. 6, No. 7, p. 101-105, July, 1975, 4 fig., 22 ref.

Descriptors: *Waste disposal, Environmental effects, *Water pollution effects, *Commercial shellfish, *Lobsters, *Crabs, *Animal pathology, *Diseases, *Sewage sludge, *Benthic fauna, Invertebrates, Crustaceans, Dissolved oxygen, Dredging, New York.
Identifiers: *New York Bight, *Shell disease, *Homerus americanus.

Dumping grounds in New York Bight receive very large quantities of sewage sludge. Lobsters and rock crabs collected in or near the dumping grounds sometimes show various pathological conditions of the shell and gills. In this study the histopathology of 'shell disease,' the causative agents and its effects on respiration are discussed in connection with a possible association with the disposal of solid wastes into the ocean. (Katz)
W77-01500

ARTIFICIAL ISLANDS: INFORMATION NEEDS AND IMPACT CRITERIA,
Delaware Univ., Lewes. Marine Studies Center.
For primary bibliographic entry see Field 6G.
W77-01501

INCIDENCE OF SHELL DISEASE IN SHRIMP IN THE NEW YORK BIGHT,
National Marine Fisheries Service, Highlands, N. J. Sandy Hook Lab.
V. H. Gopalan, and J. S. Young.
Marine Pollution Bulletin, Vol. 6, No. 10, p. 149-153, October, 1975. 1 tab., 5 fig., 26 ref.

Descriptors: *Shellfish, *Animal diseases, *Shrimp, Diseases, Water pollution effects, *Crustaceans, *Food chains, *Pathology, *Infection, Environmental effects, Invertebrates, Laboratory tests, Sampling, Microscopy, Analytical techniques, New York.
Identifiers: *New York Bight, *Shell disease, Crangon spp.

Incidence of shell disease in shrimp is as high as 30 percent in certain localities in the New York Bight. Gross examination and histopathological preparations revealed cracking and pitting of the exoskeleton, common characteristics of crustacean shell disease, followed by necrosis of underlying tissue. Aquarium studies, including tests of the effects of an antibiotic, indicated a possible infectious etiology. The disease may be related to pollution of the habitat by organic wastes including cellulose. (Katz)
W77-01502

THE EFFECT OF TWO COMMERCIAL HERBICIDES ON THE SETTLEMENT, GERMINATION AND GROWTH OF ENTEROMORPHA,
Newcastle-upon-Tyne Univ. (England). Dept. of Plant Biology.
B. Moss, and P. Woodhead.
Marine Pollution Bulletin, Vol. 6, No. 12, p. 189-192, December, 1975. 3 fig., 14 ref.

Descriptors: *Mortality, *Lethal limit, *Herbicides, *Algae, *Pest control, *Aquatic weed control, *Toxicity, Mode of action, *Nuisance algae, *Paraquat, Pesticides, Antifouling materials, Laboratory tests, *Growth stages, Water pollution effects.
Identifiers: *Enteromorpha spp., *Amitrole.

Enteromorpha spp. are virulent ship fouling organisms. Paraquat and amitrole, two commercial herbicides, were tested as possibly effective in killing the weed or as a deterrent to its initial settlement and growth. Laboratory tests indicated a complete recovery of Paraquat from test cultures indicating that paraquat is absorbed by the algal cells, and released after killing the cells. Concentrations of 71 and 142 mg/l of paraquat was toxic to the zygotes and clumped individuals were more resistant to the herbicide than were individuals. Amitrole was effective at an earlier developmental stage of Enteromorpha than was paraquat. Growth was greatly reduced in amitrole solutions of 25 mg/l. Enteromorpha is exhibited an extremely high tolerance to these two pesticides. (Katz)
W77-01503

THE BACTERIOLOGY OF POWER STATION EFFLUENT USED TO FARM MARINE FISH,
University of Strathclyde, Glasgow (Scotland). Dept. of Applied Microbiology.
A. Gilmour, M. F. McCallum, and M. C. Allan.
Aquaculture, Vol. 7, No. 4, p. 357-362, 1976. 2 tab., 11 ref.

Descriptors: *Fish farming, *Bacteria, *Pseudomonas, Effluents, *Reclaimed water, *Fish management, Powerplants, Aquatic bacteria, Populations, *Aquiculture, Chlorination, Thermal pollution.
Identifiers: *Achromobacter, *Alcaligenes, *Agrobacterium.

Power station effluent used in an experimental marine fish farm was analyzed for bacterial content. Duplicate water samples from an unstocked tank and from each of four tanks stocked with starved plaice were analyzed both quantitatively and qualitatively. It was found that bacterial counts obtained from samples taken from stocked tanks were significantly higher than those taken from an unstocked tank. Allowing for limited sampling, the flora of the water circulating through an unstocked tank did not differ radically from the flora of the water following the addition of starved fish. The predominant group was the Pseudomonas Group IV/Achromobacter/ Alcaligenes/Agrobacterium Group. (Katz)
W77-01505

CULTURE STUDIES ON THE EFFECTS FROM BORATE POLLUTION ON THE GROWTH OF MARINE PHYTOPLANKTERS,
Fisheries and Marine Service, Vancouver (British Columbia). Vancouver Lab.
N. J. Antia, and J. Y. Cheng.
Journal of the Fisheries Research Board of Canada, Vol. 32, p. 2487-2494, 1975, 2 fig., 4 tab., 25 ref.

Descriptors: Environmental effects, *Phytoplankton, Water pollution sources, Water pollution effects, *Lethal limit, *Toxicity, *Bioassay, Population, *Algae, *Pulp wastes, *Adaptation, Laboratory tests, Water quality, Industrial wastes, Primary productivity.
Identifiers: *Borate, *Boric acid.

The autotrophic growth of 19 species of marine phytoplankters, from 10 classes of algae, was tested on axenic cultures with boric acid additions of 0-100 mg/liter B to a controlled seawater medium. Growth inhibition occurred in 26 percent of the species at 50 mg/liter B and in 63 percent of species at 100 mg/liter B. Both adaptation period and degree of inhibition lessened on sequential transfer of certain species from lower to higher boron concentration. These results predict that, in the absence of stress from nutrient deficiency and adverse pH conditions, inorganic borate pollution would be tolerated by phytoplankton up to 10 mg/l B while concentrations up to 100 mg mg/l B would cause species redistribution. (Katz)
W77-01506

TOXICITY OF 30-MINUTE EXPOSURES OF RESIDUAL CHLORINE TO THE COPEPODS LIMNOCALANUS MACRURUS AND CYCLOPS BICUSPIDATUS THOMASI,
Wisconsin Univ., Milwaukee. Center for Great Lakes Studies.
D. L. Latimer, A. S. Brooks, and A. M. Beeton.
Journal of the Fisheries Research Board of Canada, Vol. 32, p. 2495-2501, 1975, 2 fig., 3 tab., 16 ref.

Descriptors: *Bioassay, *Chlorine, *Chlorination, *Toxicity, *Lethal limit, Effluents, *Cooling water, *Copepods, *Plankton, *Temperature, Water treatment, Water quality control, Water pollution sources, Power plants, Aquatic life, Thermal pollution, Water pollution effects.
Identifiers: *Limnocalanus spp., *Cyclops spp.

Laboratory bioassays were conducted at 5, 10, 15 and 20 C to determine the toxicity of residual chlorine, as might be found in power plant cooling waters, to two copepods. The 30-minute TL50 was 1.54 mg/l for Limnocalanus macrurus at 5 and 10 C. For Cyclops bicuspidatus thomasi, the 30-minute TL50 values at 10, 15 and 20 C were 14.68, 15.61 and 5.76 mg/l, respectively. Predicted safe concentrations, using 5 percent mortality for 30-minute exposures were 0.9 mg/l for L. macrurus and 0.5 mg/l for C.b. thomasi. These concentrations roughly coincide with the maximal chlorine levels characteristic of most power plant effluents. (Katz)
W77-01507

ACUTE TOXICITY OF CHLORINE TO SELECTED ESTUARINE SPECIES,
Virginia Inst. of Marine Sciences, Gloucester Point.
M. H. Roberts, Jr., R. J. Diaz, M. E. Bender, and R. J. Huggett.
Journal of the Fisheries Research Board of Canada, Vol. 32, p. 2525-2528, 1975. 1 tab., 6 ref.

Descriptors: Sewage treatment, *Chlorine, Laboratory tests, *Bioassay, *Toxicity, *Molluscs, *Larvae, *Lethal limit, *Water quality, *Estuaries, Water pollution effects, Disinfection, Oysters, Clams, Copepods, Shrimp, *Pollutant identification.
Identifiers: *Acartia spp., Crassostrea spp., Mercenaria spp.

Two flowing water systems designed to test the acute toxicity of chlorine in estuarine water are described. One is adapted for microscopic species and the other for larger species. Acute toxicity results for several invertebrate and fish species are presented. Molluscan larvae and Acartia tonsa were the most sensitive species tested, with 48-h TL50 values less than 0.005 ppm. (Katz)
W77-01508

THE EFFECT OF THE PRELIMINARY ADAPTATION TEMPERATURE ON THE DISTRIBUTION OF JUVENILE COD (GADUS MORHVA) AND POLLOCK (POLLACHIUS VIRENS) WITHIN A TEMPERATURE GRADIENT,
Murmanskii Morskoi Biologicheskii Institut (USSR).
Y. V. Tat'yankin.
Journal of Ichthyology (English Translation) Vol. 14, No. 5, 1975, p 755-760, 2 fig, 3 tab, 16 ref. Translated from Russian.

Descriptors: *Environmental effects, *Adaptation, *Temperature, Fish, Laboratory investigations, Juvenile fish, *Distribution, Water pollution effects.
Identifiers: *Cod, *Pollock, Gadus morhua morhua, Pollachius virens.

The study was conducted in the years 1967-1969 on cod and pollock underyearlings in August-September and on yearlings and 2 year old fish in January-February. The temperature was altered by approximately 8 C so that the fish were exposed to winter temperatures in the summer and to summer temperatures in the winter. The temperatures selected by the fish under temperature gradient conditions were dependent on the temperature of the preliminary adaptation with the zones of selected temperatures being in the same direction as the action of the adaptation temperature. Dependence on the temperature of preliminary adaptation was related to the specific and age characteristics of the fish. The adaptation process is completed most rapidly in older cod by comparison with younger pollock and cod of the same age. Adaptation was more rapid to high than to low temperatures. (Chilton-ORNL)
W77-01509

LARVAL CONTRACAECUM (NEMATODA, ANISKIDAE) IN THE PERICARDIUM OF FISHES FROM EAST AFRICAN LAKES,
Hebrew Univ., Jerusalem (Israel). Heinz Steinitz Marine Biology Lab.
I. Paperna.
Proc Helminthol Soc Wash. 41(2), p 252, 1974.

Descriptors: *Fish parasites, *Worms, Nematodes, Africa, Lakes, *Tilapia.
Identifiers: *Anisakidae, Bagrus-docmac, Contracaecum, Haplochromis-spp., *Lake George, Tilapia-nilotica, *Lake Victoria.

Contracaecum worms were found in the pericardial cavity of Tilapia nilotica (in 35% of 78 fish) and in Haplochromis spp. from Lake George (in 0.4% of 487 fish) and N. Lake Victoria (in 1% of 184 fish), and in Bagrus docmac from Lake George (in 2% of 47 fish). Anatomical characteristics of the worms are described. Usually, only 1 worm was found per infected fish. None of the infected T. nilotica showed signs of emaciation, but some Haplochromis were emaciated.--Copyright 1975, Biological Abstracts, Inc.
W77-01545

ENVIRONMENTAL POISONS.
Svenska Naturskyddsforeningen: Stockholm, Sweden. 1974. 32 p, Landell, Nils-Erik (Ed.).

Descriptors: *Industrial wastes, *Pesticide toxicity, *Law enforcement, *Regulation, *Herbicides, *Pesticides, *Insecticides, *Water pollution sources, *Fish, *Wildlife, *Poisons, Metals, DDT, DDD, Aldrin, Dieldrin, Polychlorinated biphenyls, Fungicides, Seed treatment, Mercury, Plankton.

Identifiers: Malathion, Parathion, Pyrethrum, Sweden, Food concentrations, Methylmercury, Phenylmercury.

The damaging effect of modern industrial poisons (biocides) is reviewed in light of the present laws in Sweden regarding DDT, DDD, polychlorinated biphenyls, aldrin, dieldrin, herbicides, phosphate insecticides (parathion, malathion, etc.), and pyrethrum. The accumulation of DDT, DDD and polychlorinated biphenyls in the food cycle of plankton, fish and mammals is discussed. In Sweden, the use of methylmercury as a seed disinfectant from 1940-1966 and the use of phenylmercury by the forest products industries proved particularly destructive to birds and produced a high Hg content in fish. Tolerable food concentrations of biocides and metals and the concentrations actually found in human organs and in animals, birds and fish are given. In Sweden, 4000 tons of biocides are used yearly, 75-80% herbicides, 6-8% insecticides and the rest fungicides. The State Nature Protection Department has supervised the production of biocides and their use since July 1973. The State Food Authorities also take part. A summary of study material on the damaging effects of biocides provided by the Swedish Society for the Protection of Nature and a bibliography conclude the booklet.–Copyright 1975, Biological Abstracts, Inc.
W77-01547

5D. Waste Treatment Processes

AN EXPLORATORY STUDY OF POSSIBLE ENERGY SAVINGS AS A RESULT OF WATER CONSERVATION PRACTICES,
Oklahoma Univ., Norman. Bureau of Water and Environmental Resources Research.
For primary bibliographic entry see Field 3E.
W77-01052

A FEASIBILITY/DEVELOPMENT STUDY FOR THE REMOVAL OF AMMONIA FROM WASTEWATER USING BIOLOGICALLY REGENERATED CLINOPTILOTITE,
Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.
M. J. Semmens.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-260 512, Price codes: A08 in paper copy, A01 in microfiche. Research Report No. 115, Illinois Water Resources Center, Urbana, August 1976. 141 p, 49 fig, 8 tab, 62 ref. OWRT A-080-ILL(1), 14-31-0001-6014.

Descriptors: *Waste water treatment, *Nitrification, *Ion exchange, *Heavy metals, Biological treatment, Nitrogen, Salts, Toxicity, Recycling, Nitrogen fixing bacteria, Barium, Lead, Copper, Cadmium, Zinc, Costs.
Identifiers: *Ammonia removal, *Regeneration, *Clinoptilotite, Ammonium nitrogen.

Ammonium nitrogen may be readily removed from wastewaters by means of an ammonium selective ion exchanger, clinotpilolite. The major cost in this process is the cost of regenerating the exchanger in order that it may be reused. Results are presented of a study to develop a process in which nitrifying bacteria were employed to regenerate the exchanger. The biological regeneration process is shown feasible in both batch and column studies. The mechanism of regeneration was ion exchange followed by nitrification of the liberated ammonium. The influences of salt concentration, salt composition, particle size, dissolved oxygen, aeration tank configuration, and aeration tank size on the rate of regeneration were identified. The selectivity of clinoptilolite for barium, lead, copper, cadmium and zinc was measured in exchange for sodium. To further identify possible toxic effects of heavy metals toxicity studies were conducted with free and complexed copper.
W77-01057

A SOLUTION PROCEDURE FOR THE DESIGN PROBLEM OF A MULTIPLE TREATMENT PLANT SYSTEM ALONG A STREAM,
McGill Univ., Montreal (Quebec). Dept. of Civil Engineering and Applied Mechanics.
D. Panagiotakopoulos.
Working Paper, UESE 76-12, Department of Civil Engineering and Applied Mechanics, McGill University, Montreal, Canada, May 1976. 5 fig, 5 tab, 10 ref.

Descriptors: *Liquid wastes, *Treatment facilities, *Methodology, *Linear programming, Optimization, Dynamic programming, Decision making, Networks, Streams, Efficiencies, Operations, Dissolved oxygen, Standards, Hudson River, Constraints, Mathematical models, Systems analysis, Equations, *Design, Criteria.
Identifiers: *Cost minimization.

The design problem of liquid waste treatment plants in a multiplant system along a stream entails the selection of a sequence of unit operations for each plant, as well as the determination of each operation's waste removing efficiency, so that the dissolved oxygen standards along the stream are met at minimum cost. The suggested solutions have so far been partial and suboptimal since they consider only the efficiencies on a fixed sequence of unit operations, neglecting the question of choice among them. This paper outlines an efficient two-phase procedure for completely solving this multi-plant system problem by determining for each plant both the best set of operations and their efficiences. First, a network algorithm is developed for generating concave cost-efficiency curves for each plant such that each plant efficiency level corresponds to the optimal rather than to a pre-specified fixed sequence of operations. Second, a linear programming model with concave and separable objective function is employed for allocating treatment requirements among the plants. The procedure is compared with existing ones through an application to a real case. (Bell-Cornell)
W77-01165

COAL AND THE ENVIRONMENT, ABSTRACT SERIES, MINE DRAINAGE BIBLIOGRAPHY, 1910-1976.
Bituminous Coal Research, Inc., Monroeville, Pa.
For primary bibliographic entry see Field 5G.
W77-01192

PROCESS FOR EXTRACTING DISSOLVED SALTS FROM WATER,
Dames and Moore, San Francisco, Calif. (Assignee).
For primary bibliographic entry see Field 3A.
W77-01198

APPARATUS FOR TREATING LIQUIDS,
Uddeholms A. B., Hagfors (Sweden). (Assignee).
B. H. Nilsson.
U. S. Patent No. 3,968,038, 7 p fig, 6 ref; Official Gazette of the United States Patent Office, Vol 938, No 1, p 249, July 6, 1976.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Industrial wastes, Water pollution control, Water quality control, Filtration, Filters, Resins, Ion exchange, Water purification, Pulp and paper industry, Equipment.

The apparatus was developed primarily for use in connection with purifying waste-water from woodpulp and paper mills. Purification of wastewater by passing the water through a particulate bed in a column or tank is usually carried out cyclically, with purification phases alternating with phases in which the bed is backwashed so as to be regenerated or cleansed from the captured impurities. on changing over to the purification phase from the backwash phase a 'tail effect' occurs, resulting in pollution of the purified water by impurities from the preceding backwash phase remaining in the liquid collecting and distributing compartment in the tank bottom structure. This lag or slow response of the apparatus and the resulting 'tail effect' are proportional to the volume of the tank bottom compartment. The object of this invention is to reduce the tail effect by providing a tank bottom structure that has a small volume. The liquid treating apparatus is provided with a tank in which the bottom structure is comprised of upper and lower bottom plates which are perforated and define between them the bottom compartment which is connected with the filter bed through openings in the upper bottom plate. The liquid withdrawal or supply pipes are through openings in the lower bottom plate. The apparatus has excellent strength and the volume of the bottom compartment can be substantially reduced without consequent reduction of the capability of the bottom structure to support heavy beds. (Sinha-OEIS)
W77-01210

METHOD AND APPARATUS FOR THE PURIFICATION OF A LIQUID CONTAMINATED WITH RADIOACTIVE SUBSTANCES,
Luwa A. G., Zurich (Switzerland). (Assignee).
H. Mende.
U.S. Patent No. 3,969,194, 8 p, 7 fig, 4 ref; Official Gazette of the United States Patent Office, Vol 948, No 2, p 641, July 13, 1976.

Descriptors: *Patents, *Waste water treatment, *Radioactive wastes, *Water pollution sources, *Water purification, Water pollution treatment, Evaporation, Mixing.
Identifiers: Washing.

A method of and apparatus for the purification of a liquid contaminated with radioactive substances is described. The liquid is infed to an evaporator in or with which there is connected a column having a multiplicity of superposed plates or floors. The vapor generated in the evaporator is guided through a washing or scrubbing liquid uniformly distributed at the floors and flowing in crosswise counterflow with regard to the vapor. The washing liquid at the floors is deflected a number of times in such a manner that the washing liquid itself and together with the droplets entrained by the vapor is uniformly admixed and the washing liquid subjected to a constant intake of the radioactive substance. (Sinha-OEIS)
W77-01216

WASTE WATER TREATMENT,
Swift and Co., Chicago, Ill. (Assignee).
E. R. Ramirez.
U. S. Patent No. 3,969,203, 5 p, 5 ref; Official Gazette of the United States Patent Office, Vol 948, No 2, p 644, July 13, 1976.

Descriptors: *Patents, *Waste water treatment, *Industrial wastes, *Organic wastes, *Oily water, *Water pollution treatment, Water pollution control, Water quality control, *Electrodes, Bubbles, Froth flotation, Coagulation, Water reuse.
Identifiers: Packinghouse operations wastes.

Industrial waste water containing suspended particls such as mineral oil, fats, proteins, glycerides, fibers, and biodegradable material is treated by exposing the water to a number of positive and negative electrodes. High current densities are used to create large volumes of microbubbles which float the particles to the surface. The current is reversed periodically to keep the cathodes clean. (Sinha-OEIS)
W77-01217

METHOD FOR USING MACROAMINE POLYMERS AS FLOCCULATING AGENTS,
Chemical (B. R.), Co. Ltd., Tokyo (Japan). (Assignee).
I. Shinohara, and J. Aoyagi.

U.S. Patent No. 3,969,239, 8 p, 2 fig, 6 tab, 4 ref; Official Gazette of the United States Patent Office, Vol 948, No 2, p 655, July 13, 1976.

Descriptors: *Patents, *Waste water treatment, *Industrial wastes, *Water pollution treatment, *Water purification, *Flocculation, Coagulation, Chemical reactions, Organic compounds, *Polymers, Ions.

In a process for treating water to remove dissolved and suspended impurities such as metallic ions, bentonite or dye stuffs, an effective amount of a water soluble linear macroamine polymer is dissolved in the water. The water-soluble macroamine polymer is used as a flocculating or coagulating agent in clarifying, precipitating and decoloring water. The polymer is one having at least about 65 mol per cent amine content and not greater than about 23 mol per cent polyene content. The process for preparing the polymer is described. (Sinha-OEIS)
W77-01218

CHROMIUM REMOVAL AND RECOVERY PROCESS,
Cunningham (John), Portsmouth, Ohio (Assignee).
E. J. Feltz, and R. Cunningham.
U. S. Patent No. 3,969,246, 6 p, 1 fig, 4 tab, 4 ref; Official Gazette of the United States Patent Office, Vol 948, No 2, p 657-658, July 13, 1976.

Descriptors: *Patents, *Waste water treatment, *Industrial wastes, *Chemical wastes, *Separation techniques, Water pollution treatment, Water pollution control, Chemical precipitation, Chemical reactions, Chromium, Metals, Filtration, Water reuse, Hydrogen ion concentration.
Identifiers: Metal recovery.

A process is described for removing and recovering chromium from waste water in the form of chromic acid and/or metallic chromate salts by the direct precipitation of chromium using barium carbonate in aqueous solutions acidified with glacial acetic acid at an acidic pH preferably ranging from 4.5 to 4.7. This is followed by filtering the resultant chromium material with an acid resistant filter media having openings in the 2 to 4 micron size range and acid-resistant with the pH range of 2 to approximately 5. The weight ratio of barium carbonate to chromium material contained in the waste liquid is preferably 2:1 and the preferable weight ratio of the barium carbonate to the acetic acid is 3:1. The barium carbonate and acetic acid are freshly mixed in aqueous media prior to either addition to the chromium waste liquid or addition of the chromium waste liquid to the freshly prepared treating material in aqueous media. (Sinha-OEIS)
W77-01220

HEAVY METAL ADSORBENT PROCESS,
Agency of Industrial Science and Technology, Tokyo (Japan). (Assignee).
K. Terajima, S. Tomita, Y. Matsuda, and K. Abe.
U.S. Patent No. 3,970,553, 4 p, 3 tab, 3 ref; Official Gazette of the United States Patent Office, Vol 948, No 3, p 1100, July 20, 1976.

Descriptors: *Patents, *Waste water treatment, *Industrial wastes, *Heavy metals, *Water pollution treatment, Water pollution sources, Water pollution control, Adsorption.
Identifiers: Nitrohumic acid.

Nitrohumic acid exhibits high adsorptivity for heavy metals dissolved in water and is easily regenerated by the action of an acid. However, this compound is low in mechanical strength when shaped into granules. An object of this invention is to provide a method of using a heavy metal adsorbent composed predominantly of nitrohumic acid, which is insoluble with high mechanical strength. The heavy metal adsorbent can be prepared by the following method. Nitrohumic acid is mixed with the carboxyl group-containing polymeric compound and the mixture is kneaded with an aqueous solution of alkali. The kneaded mixture can be first shaped into granules in a conventional manner and then subjected to an acid treatment for insolubilization, or, alternatively, first subjected to an acid treatment for insolubilization and then shaped into granules. When the heavy metal adsorbent of this invention is brought into contact with an aqueous solution containing heavy metals by a suitable means, the adsorbent adsorbs the heavy metals thus serving to eliminate heavy metals effectively from industrial effluent. The adsorbent thus used can easily be regenerated by washing with a solution of a strong mineral acid such as hydrochloric acid or sulfuric acid. (Sinha-OEIS)
W77-01226

PROCESS FOR DETOXIFICATION OF CYANIDES AND NITRILES WITH PEROXYGEN COMPOUNDS,
Deutsche Gold- und Silber-Scheideanstalt A. G., Frankfurt-am-Main (West Germany). (Assignee)
J. Fischer, H. Knorre, and G. Pohl.
U.S. Patent No. 3,970,554, 7 p 8 fig, 7 ref; Official Gazette of the United States Patent Office, Vol 948, No 3, p 1100, July 20, 1976.

Descriptors: *Patents, *Waste water treatment, *Industrial wastes, *Chemical wastes, Water pollution sources, *Water pollution treatment, Water pollution control, Water purification, Chemical reactions, Electrochemistry, Oxidation, Electrodes, Catalysts.
Identifiers: *Cyanides, Hydrogen peroxide, *Nitriles.

Waste water containing cyanides, Cyanohydrins and/or organic nitriles are detoxified by adding a peroxide compound in the presence of iodide ion or free iodine, in a given case in the presence of silver ions. Through these additions not only is the reaction considerably accelerated but it is also possible to follow and regulate the reaction potentiometrically, namely, with the help of a silver electrode and a calomel or thalamide electrode as reference electrode. The end of the detoxification reaction is indicated by a clear potential jump over several hundred millivolts which also can be used as the signal for the regulation of the hydrogen peroxide addition. Since the operation is carried out with an excess of iodide over silver, the silver is quantitatively separated from the solution as difficulty soluble silver iodide after the detoxification reaction and can recovered, reprocessed and added again. Excess iodine does not disturb the subsequent biological clarification of the waste waters, but catalyzes the breakdown. (Sinha-OEIS)
W77-01227

CONDITIONING HIGHLY RADIOACTIVE SOLIDIFIED WASTE,
Gesellshaft fuer Kernforschung m.b.H., Karlsruhe (West Germany).
W. Hild, H. Krause, K. Scheffler, H. Gusten, and E. Gilbert.
U.S. Patent No. 3,971,717, 7 p, 5 ref; Official Gazette of the United States Patent Office, Vol 948, No 4, p 1509, July 27, 1976.

Descriptors: *Patents, *Waste water treatment, *Radioactive wastes, *Radioactive waste disposal, Radioactivity effects, Water pollution treatment, Water pollution control, Water purification, Radiation, Cooling.

Highly radioactive wastes, such as fission-product solutions resulting from processing irradiated nuclear fuels, are converted to solid, stable and substantially water-insoluble products before they are transported to a final storage location in conformance with environmental protection requirements. Highly radioactive solidified waste, incorporated in molded bodies of glass, ceramic or a basaltic mass, is introduced into waste water and/or settling or precipitated sludge from community or industrial systems (in order to sterilize, improve the filterability of and condition (a) the waste water before it is introduced into a receiving stream and (b) the sludge before it is composted) and is left to remain there until the heat energy produced by the radioactive radiation has been reduced in its order of magnitude to one tenth of the amount available in the molded bodies upon their completion. The molded bodies, which may be sheathed or coated, are alternatively introduced into raw water used for preparing drinking water in order to sterilize it and are left to remain therein until heat energy produced by the radioactive radiation has been reduced in its order of magnitude to one tenth of the amount available in the freshly prepared molded bodies. An object of the invention is to find a better way to utilize available ultimate storage locations in salt stocks and to reduce the cost of noncontaminating removal or final storage of highly radioactive waste. (Sinha-OEIS)
W77-01233

ULTRAVIOLET WATER PURIFIER,
For primary bibliographic entry see Field 5F.
W77-01234

THEORY OF STORAGE AND TREATMENT-PLANT OVERFLOWS,
C. D. D. Howard.
Journal of the Environmental Engineering Division, American Society of Civil Engineers, Vol. 102, No. EE4, Proceedings Paper 12310, p 709-722, August 1976. 5 fig, 5 ref, append.

Descriptors: *Runoff, *Sewage treatment, *Overflow, *Storage, *Storm runoff, Combined sewers, Economics, Hydrology, Precipitation, Storm drains, *Treatment facilities, Equations, Computer models, Waste water treatment, Performance.
Identifiers: Storage and treatment plant combination.

The effectiveness of storage in combination with a treatment plant for storm runoff depends on the capacities of the two facilities and the number, duration, and volumes of runoff events which these facilities must process. Computer simulation models can be used for direct evaluation; this paper presented a complementary theoretical method. The theory used a probabilistic description of precipitation as determined from local records and developed statistics of untreated discharge through mathematically derived probability functions. A number of important assumptions were made since it is known that such problems can be mathematically unsolvable. It was concluded that the theory is probably not a practical substitute for computer simulation, but it should provide a means for directing more detailed computer analysis towards the most cost-effective combinations of storage and treatment. (Lardner-ISWS)
W77-01335

A MUNICIPAL ENGINEER LOOKS AT WATER POLLUTION.
Public Health, Vol 75 (11), p 347-351, (1975).

Descriptors: Municipal water, Water supply sources, Drainage, Stormwater, Sewerage, Sewage treatment, Recreation, Water pollution, Water supply, Waste water disposal, *Waste water treatment.
Identifiers: South Africa, New Zealand.

A New Zealander gives his views on the functions of a City Engineer and describes his approach to pollution as regards water supply, disposal of stormwater and waste water and in the recreational use of water. He recognises that the use of water resources is a complex issue and the best solution to a pollution aspect must give due con-

sideration to the wants and wishes of the people in the whole region affected. (South Africa)
W77-01359

METALS IN URBAN DRAINAGE SYSTEMS AND THEIR EFFECT ON THE POTENTIAL RE-USE OF PURIFIED SEWAGE,
National Inst. for Water Research, Pretoria (South Africa).
J. W. Funke.
Water SA., Vol. 1(1), p 36-44, (1975). 2 fig, 7 tab, 11 ref.

Descriptors: *Heavy metals, Metals, *Biological treatment, *Water reuse, Industrial water, *Industrial wastes, *Sewage treatment, Urban drainage, *Waste water treatment, Potable water, Sewage effluents.
Identifiers: South Africa, Metal processing wastes.

Information is provided on the removal of heavy metals by biological sewage purification operations and their effect on the performance of such systems. Also discussed is the limited impact of present concentrations of heavy metals in the Pretoria, Johannesburg and Springs purified sewage effluents on the reclamation of potable and industrial water. Authorities are urged to take a realistic approach in dealing with industrial pollution problems. (South Africa)
W77-01362

THE REMOVAL OF SALT AND ORGANIC MATERIAL FROM SEWAGE EFFLUENT BY ANION EXCHANGE RESINS,
Cape Town Univ. (South Africa). Dept. of Chemical Engineering.
T. B. S. Giddey, J. W. De Kock, and A. D. Carr.
Water SA., Vol 1(1), p 24-29, (1975). 2 fig, 3 tab, 3 ref.

Descriptors: Organic matter, Nitrogen, Phosphorus, *Sewage treatment, Ion exchange, *Resins, *Anion exchange, Salts, *Waste water treatment, Chemical oxygen demand, Sewage effluents, *Desalination.
Identifiers: South Africa.

The removal of both organic material and anions from a domestic sewage effluent has been investigated using two weak base anion exchange resins. The resins are the gel-type Amberlite IRA-68 and the macroreticular-type Amberlite XE-275. Both resins are effective in reducing the COD as well as removing the anions present, though the XE-275 resin shows a higher drop in operating capacity. When linked with a cation column, total nitrogen and phosphate removals can be obtained. (South Africa)
W77-01364

DISSOLVED AIR (PRESSURE) FLOTATION - AN EVALUATION OF INTER-RELATIONSHIPS BETWEEN PROCESS VARIABLES AND THEIR OPTIMISATION FOR DESIGN,
Cape Town Univ. (South Africa). Dept. of Water Resources and Public Health Engineering.
J. Bratby, and G. vr Marais.
Water SA., Vol 1, No. 2, p 57-69, 1975. 22 fig, 3 ref.

Descriptors: *Flotation, *Activated sludge, *Sludge treatment, Cost-benefit analysis, Economics, Design criteria, *Waste water treatment, Aeration, Optimization.
Identifiers: Sludge thickening, South Africa, *Pressure flotation, Flotation tanks.

Dissolved-air flotation applied to activated sludge mixed liquor (at a sludge age of approximately 15 d) showed that bubble-particle attachment occurred efficiently with no form of chemical addition required. Experiments conducted to determine the inter-relationships between process parameters showed that three basic relationships are necessary for design. From an economic optimisation of design variables, for lowest total cost (capital plus capitalised running costs) there is an optimum value related to the wastewater solids concentration and an optimum value related to the float solids concentration. From an economic viewpoint the saturator pressure applied is immaterial provided the recycle ratio is such that, in combination with saturator pressure, the optimum air/solids ratio is achieved. Total costs (capital plus capitalised running costs) for dissolved-air flotation systems are computed for a range of wastewater concentrations, flow rates and float solids concentrations. A design example is presented for thickening activated sludge mixed liquor to a concentration of 6%. (South Africa)
W77-01367

SOUTH AFRICAN PROCESS ELIMINATES DAM POLLUTION.
Construction in Southern Africa, Vol 19 (11), p. 65, (1975).

Descriptors: *Sewage treatment, *Nutrient removal, *Phosphates, *Nitrogen, Pollution abatement, *Waste water treatment, *Aeration, Patents.
Identifiers: *South Africa.

South Africa's Council for Scientific and Industrial Research's National Institute for Water Research has developed a process which can remove nitrates and phosphates from sewage without addition of chemicals. The removal of these nutrients from purified sewage effluents is important because their presence give rise to undesirable algae growth in natural waters into which the sewage is discharged. The process has been patented by the S A Inventions Development Corporation. Two South African companies and one American firm have already been licenced to use the process. (South Africa)
W77-01377

WATER RECLAMATION - QUALITY TARGETS AND ECONOMIC CONSIDERATIONS,
National Inst. for Water Research, Pretoria (South Africa).
L. R. J. Van Vuuren.
Water S A., Vol 1(3), p 133-143, (1975). 4 fig, 10 tab, 6 ref.

Descriptors: *Water reuse, Potable water, Water quality standards, Capital costs, Economics, Treatment facilities, Waste water treatment.
Identifiers: South Africa, South West Africa, Windhoek.

Full-scale reclamation of secondary effluents, both for industrial and unrestricted re-use, has been practised in Southern Africa for a number of years. Cost estimates for potable re-use have confirmed that a high quality water conforming to WHO Standards can be produced at a cost of some 10c/kl. Industrial re-use can produce water at competitive prices. This would offer a rational solution to the increasing demand for water. Operation of reclamation plants for potable re-use requires strict operational control from a health point of view. Risks can be greatly reduced by upgrading the performance of sewage treatment plants and by segregation of industrial toxic wastes. A better approach would be to plan new sewage treatment works as an integral part of a water reclamation system. In this regard, chemical pretreatment followed by biological denitrification and active carbon adsorption appears to be more promising. (South Africa)
W77-01440

FULL SCALE EXPERIMENTATION ON THE NEW JOHANNESBURG EXTENDED AERATION PLANTS,
Johannesburg City Health Dept. (South Africa).
H. A. Nicholls.
Water S A., Vol 1 (3), p 121-132, (1975). 20 fig, 3 tab, 7 ref.

Descriptors: Flocculation, *Aeration, Sewage treatment, Denitrification, Phosphorus, Sludge treatment, *Waste water treatment, *Treatment facilities.
Identifiers: *Johannesburg, *South Africa, *Extended aeration, Bardenpho process, Aeration tanks.

The theories of three workers were found to be correct on full scale experimentation, namely, the Marais development of the long solids, retention time concept, the Pitman development of the biological flocculation concept, the Bardenpho process developed by Barnard to remove nitrate, and lastly, the modified Bardenpho process to remove nitrate and phosphate. This paper points out the benefits derived from full scale experimentation on the above concepts. (South Africa)
W77-01441

ECONOMIC ASPECTS OF WASTEWATER TREATMENT IN SOUTH AFRICA,
Johannesburg City Health Services (South Africa).
V. N. Bolitho.
Water S.A., Vol 1 (3), p 118-120, (1975). 2 tab.

Descriptors: *Urbanization, *Waste water treatment, *Economics, Municipal water, Potable water, Sewerage, Industrial waste, *Aeration, *Treatment facilities, Construction costs.
Identifiers: *South Africa, *Extended aeration.

Rapid expansion of urban populations in South Africa will require additional waste water treatment facilities with a capacity of 10 000-12 000 Ml/d. The cost of constructing plant unit of 100 Ml/d capacity and employing the extended aeration process is estimated at R4,25m with operating cost of 2,25 c/m3. Methods of sludge disposal are changing and new cost structures will have to be taken into account. Estimated investments and running costs for waste water facilities in South Africa during the next 25 years are given. Economic considerations are discussed for the following: purifying municipal effluents to various standards of purity, including that of potable water; industrial waste treatment; and regional sewerage schemes. (South Africa)
W77-01444

SAND 'SPONGE' WILL STORE RECLAIMED WATER.
For primary bibliographic entry see Field 4B.
W77-01451

THE TREATMENT OF WASTEWATER WITH A ROTATING DISC UNIT, (BEHANDELING VAN AFVALWATER MET DIE DRAAISKYFEENHEID).
National Inst. for Water Research, Pretoria (South Africa).
Municipal Administration and Engineering, Vol 40 (480), p 68-71, (1975). 1 fig, 2 tab, 1 ref.

Descriptors: *Sewage treatment, Oxidation, Operation and maintenance, *Waste water treatment, Ammonia.
Identifiers: South Africa, *Rotating discs.

The South African Council for Scientific and Industrial Research's (CSIR) National Institute for Water Research, used a rotating disc unit (RDU) for the treatment of waste-water where carbon and ammonia had to be oxidized and nitrates had to be reduced. The RDU can be used for improving the quality of effluent from aerobic digesters and septic tanks and require minimal maintenance as no problems with foaming or change of concentration of suspended particles are experienced. The RDU is extremely suitable for the treatment of wastewater from small communities. The RDU can oxidise 22 g chemical oxygen demand or 2 g ammonia

nitrogen per sq. meter per day or can be used to reduce 6 g nitrate nitrogen per sq meter per day. The power demand is approximately 2,5 W/m2. (South Africa)
W77-01455

THE EXPERIENCE WITH MONITORING WATER QUALITY IN WINDHOEK,
National Inst. for Water Research, Pretoria (South Africa).
W. H. J. Hattingh.
Suppl. Municipal Engineer, Vol. 5(5), p 39-44, (1974).

Descriptors: *Waste water treatment, *Treatment facilities, Water reuse, Economics, Water resources, Bacteria, Viruses, Water quality, *Monitoring, Sampling, Disinfection, *Pollutant identification.
Identifiers: South Africa, South West Africa, Windhoek, Chemical treatment.

A description is presented of the operation of the Windhoek waste water reclamation plant and the measures taken to ensure the production of a safe and potable water supply. The programme of vigilance testing, the reporting of results and the results of monitoring are discussed in detail. The author concludes that there is overwhelming evidence that reclamation can produce better quality water than a conventional water purification works when dealing with a polluted raw water supply. (South Africa)
W77-01457

A CASE FOR RECLAMATION,
National Inst. for Water Research, Pretoria (South Africa).
G. G. Cillie, and G. J. Stander.
Suppl. Municipal Engineer, Vol. 5(5), p 33-37 (1974).

Descriptors: Water reuse, Pollution abatement, Economics, Water resources, *By-products recovery, Public health, *Recycling.
Identifiers: South Africa, Windhoek.

The advantages of recycling water, especially in South Africa with its limited water resources, are outlined. It prevents water pollution whilst being an important water augmentation system for producing water conforming to the quality requirements for a wide range of uses and constitutes an economically attractive method of providing new water. The objections to water reclamation have generally pivoted on health considerations and stringent vigilant measures and monitoring will of necessity have to apply where reclamation for potable use is practised. Similar precautions are indeed necessary when polluted surface waters are processed for potable use. It is concluded that a serious responsibility rests upon the municipal engineer to ensure that optimum use is made of the most precious commodity - water. (South Africa)
W77-01458

TREATMENT OF SEWAGE WITH SPECIAL REFERENCE TO AERATION AND METHODS OF AERATION,
National Inst. for Water Research, Pretoria (South Africa).
W. H. J. Hattingh.
Public Health, Vol 75(1), p 3-13, (1975), 2 ref.

Descriptors: *Sewage treatment, *Aeration, *Activated sludge, Filtration, Denitrification, Biological treatment, *Waste water treatment.
Identifiers: South Africa.

A general survey is given of the treatment of sewage water as it is being done in the Republic of South Africa at the present time. The treatment of sewage water by means of aeration and aeration method and new developments, like denitrification, are discussed. The biological filter-bed and activated sludge processes as examples of aerobic processes, are also discussed. (South Africa)
W77-01459

THE ECONOMICS OF HANDLING SOLID WASTES (DIE EKONOMIE VAN SOLIEDE AFVALHANTERING),
National Inst. for Water Research, Pretoria (South Africa).
D. G. S. Wolmarans.
Suppl. Municipal Engineer, 5 (5), 58-62 (1974).

Descriptors: Solid wastes, Municipal wastes, Economics, Domestic wastes, Future planning, Waste treatment, Waste disposal.
Identifiers: South Africa.

Some of the economic principles concerning the handling of solid wastes, and some possible alternative approaches, are examined. What the National Institute for Water Research has done and plans to do in this regard and how liaison with the Institute can be used to advantage. Procedures are presented for solid wastes handling methods of household, industrial, garden and street refuse as well as abattoir, plastic and agricultural wastes. The conclusions reached are: (1) municipalities must look for economic solutions to the solid wastes problem; (2) they should collect information about the costs of collection, transport and processing of solid wastes; (3) they should determine how frequently waste removal need be done, and (4) they should consider the planning of regional schemes in conjunction with their neighbors. (South Africa)
W77-01461

IMPROVED ANAEROBIC DIGESTION OF SOLID URBAN WASTE,
M. Moyal.
Municipal Administration and Engineering, Vol 41 (483), p 9-10 (1975).

Descriptors: Waste disposal, Municipal wastes, *Anaerobic digestion, Energy, Energy conversion, Resources development, *Waste treatment, *Solid wastes, Gases.
Identifiers: South Africa, Resources recovery, Bio-energy conversion.

Municipal garbage may yield 1,25 barrels of crude oil or 10,000 cubic feet of gas per ton. In this way the present cumbersome liability may be turned into an asset. Three methods that may be used for gasifying are mentioned and one of the three, anaerobic digestion is discussed in more detail. (South Africa)
W77-01462

THE ENERGY POTENTIAL OF MUNICIPAL SOLID WASTES IN SOUTH AFRICA,
Stellenbosch Univ. (South Africa). Dept. of Chemical Engineering.
For primary bibliographic entry see Field 3D.
W77-01463

PACKAGE PLANT OWNER RESPONSIBILITY AND OPERATION OF SMALL SEWAGE UNITS,
N. P. Nicolle.
Municipal Engineer, Vol 5 (4), p 27-29, (1974).

Descriptors: *Sewage treatment, Biological treatment, Aeration, Operation and maintenance, Operators, *Treatment facilities, *Waste water treatment, Filters.
Identifiers: South Africa, Extended aeration, Biological filters.

The owner responsibilities are explained in ensuring that package plant sewage treatment units operate as satisfactorily as the extravagant claims made for them by their suppliers. Both conventional biological filter type and extended aeration units are discussed and daily, as well as monthly routine checks are prescribed. A description is given as to what to expect of the operator and mention is made of maintenance requirements. (South Africa)
W77-01464

ENGINEERING ECONOMICS OF WATER RECLAMATION,
A. J. Clayton.
Suppl. Municipal Engineer, Vol 5 (5), p 53-55, (1974). 1 fig, 2 tab.

Descriptors: *Waste water treatment, *Treatment facilities, Water resources, *Water reuse, Cost comparisons, Sewage treatment, Economics.
Identifiers: South Africa.

A detailed description is given of the operation of the Windhoek waste water reclamation plant discussing aeration, flocculation, pH correction, clarification, sedimentation and disInfection. Special attention is given to the economics of the operation and all aspects contributing to the total operating cost of 11,5C/K1 is analysed and tabulated. In conclusion it is stated that reclamation is an integral part of Windhoek's water supply and indications are that supply from this source will be increased in future. (South Africa)
W77-01466

FLOODS, A FISSURE AND A PERFECT HOLING.
For primary bibliographic entry see Field 8E.
W77-01470

SOLID-WASTES RECYCLING: APPREHENSIONS, MISAPPREHENSIONS AND DILEMMAS,
Johannesburg City Engineers Dept. (South Africa).
Val Bolitho.
Municipal Administration and Engineering, Vol 40(473), p 9-18, 35, (1975). 5 tab.

Descriptors: Solid wastes, Landfills, Economics, Incineration, Energy, *Recycling, Municipal wastes, Industrial wastes, Water reuse.
Identifiers: *South Africa.

The issue of solid-wastes-recycling is examined, and the conclusion is reached that we should have serious and growing concern about the long-term availability of resources. However, the cost of recovery from mixed wastes on a large scale is likely to be far higher than income from sales. Recovery can only be economic if the segregation involved can be done at very low cost, but local authorities cannot be expected to embark on idealistically motivated recycling if it involves incurring losses. Recycling outside the refuse circuit, contamination by refuse, fiscal measures for discouraging waste, assessment of controlled landfill and refuse as a direct heat source, are also discussed. (South Africa)
W77-01484

SEWER LINING,
Council for Scientific and Industrial Research, Pretoria (South Africa).
For primary bibliographic entry see Field 8G.
W77-01491

THE EPIDEMIOLOGY OF RECLAIMED WATER,
South West African Inst. for Medical Research, Windhoek.
S. S. Grove.
Suppl. Municipal Engineer, Vol 5 (5), p. 49-51, (1974).

Descriptors: *Waste water treatment, Water reuse, *Human diseases, *Epidemiology, Sur-

veys, *Public health, Africa, Potable water, Pollutant identification.
Identifiers: South Africa, *South West Africa, Hepatitis, Gastro-enteritis, Disease detection.

When reclamation of potable water was started in Windhoek the S A Water Research Commission requested the South African Institute for Medical Research to undertake a detailed epidemiological survey of the residents. Relevant available data is briefly discussed in the article under the headings of gastro-intestinal infections, central nervous system diseases, hepatitis and miscellaneous diseases. It is concluded that even though not enough information is available with which to compare the findings of the survey, taking past experience into consideration there does not appear to be any significant change in the occurrence of disease in Windhoek. (South Africa)
W77-01492

RULES AND REGULATIONS: CONFINED FEEDING OPERATIONS.
For primary bibliographic entry see Field 5G.
W77-01512

SULFURIC ACID FOR THE TREATMENT OF AMMONIATED IRRIGATION WATER: I. REDUCING AMMONIA VOLATILIZATION,
Arizona Univ., Tucson. Dept. of Soils, Water and Engineering.
For primary bibliographic entry see Field 5G.
W77-01517

THE DETERMINATION OF CADMIUM, LEAD, COPPER AND ZINC IN GROUND WATER, ESTUARINE WATER, SEWAGE AND SEWAGE EFFLUENT BY ANODIC STRIPPING VOLTAMMETRY,
Water Pollution Research Lab., Stevenage (England).
For primary bibliographic entry see Field 5A.
W77-01518

ANIMAL WASTE PROBLEMS NOW FACING THE DEPARTMENT OF NATURAL RESOURCES,
Wisconsin Dept. of Natural Resources, Madison. Industrial Waste Water Section.
For primary bibliographic entry see Field 5G.
W77-01525

MANURE DISPOSAL, POLLUTION CONTROL, AND THE NEW YORK DAIRY FARMER,
Cornell Univ., Ithaca, N. Y. Dept. of Agronomy.
D. R. Coote, and P. J. Zwerman.
New York's Food and Life Sciences Bulletin, No. 51, Physical Sciences: Agronomy, No. 3, April, 1975, 19 p. 3 tab, 100 ref.

Descriptors: *Dairy industry, *Waste disposal, *New York, Economics, Regulation, *Farm wastes, Pollution abatement, Water pollution control.
Identifiers: *Land disposal.

Fifty New York dairy farms were visited in 1971 to investigate dairy waste management problems and farmer attitudes toward economic and environmental effects of alternative waste management methods. Two distinct types of dairy farms were noted (1) those with conventional barns (cattle stayed mostly in pasture) and (2) those with freestall barns (cattle permanently confined in barn and exercise yard or pasture). In the pasture system, cattle spread their own manure; in the freestall barn, farmers disposed of the manure. Most farmers felt that all their manure could beneficially be used in field spreading. However, some freestall farmers favored 'dumping' of manure on fields, regardless of environmental effects. Existing regulations that limit pollution by dairies are discussed. Other possible legal approaches are: (1) Restrict the manure amounts to be spread on an area in one year, (2) Restrict manure spreading to soils that are not excessively permeable or excessively impermeable, (3) Restrict manure spreading to flat or only gently-sloping fields, (4) Restrict manure spreading to areas greater than some acceptable distance from surface water capable of leaving the operator's property, (5) Restrict the housing of animals and the spreading of manure to areas greater than some acceptable distance from dwellings and public areas, (6) Restrict manure spreading to certain times of the year, (7) Require that a certain minimum land area be zoned and controlled by the farm operator according to the quantity and type of animals kept, (8) Require that any form of manure disposal, other than land application meet the same controls and standards as those required for industrial or municipal effluent disposal, (9) Require that manure managing be such that no disease, odor, insect, or rodent nuisance is caused. (Penrod-East Central)
W77-01528

MANURE MANAGEMENT IN A 700-HEAD SWINE FINISHING UNIT IN THE AMERICAN MIDWEST: AN INTEGRATED SYSTEM INCORPORATING HYDRAULIC MANURE TRANSPORT WITH RECYCLED ANAEROBIC LAGOON LIQUOR AND FINAL EFFLUENT USE BY CORN (ZEA MAYS),
Iowa State Univ., Ames. Dept. of Agricultural Engineering.
C. V. Booram, and R. J. Smith.
Water Research, Vol. 8, No. 12, p. 1089-1097, 1974. 5 fig, 6 tab, 20 ref.

Descriptors: *Lagoons, *Anaerobic conditions, *Irrigation, *Nitrates, *Groundwater. Hydraulic systems, Water pollution, Crop response, Waste treatment, Corn(Field), Recycling.
Identifiers: *Land disposal.

In recent years livestock production has shifted from pasturing to intensive confinement, resulting in manure management problems. In the midwestern states, anaerobic lagooning has been tested as a management method, with use of renovated waste water for hydraulic transport. Such lagoons convert mixtures of mucal, granular and fibrous solids in manure into a liquid suspension capable of being pumped, with simple, low capacity equipment. However, lagoon liquor has proven to be far too potent to discharge into a watercourse. One solution has been to employ standard irrigation equipment to discharge excess lagoon liquor to croplands. When anaerobic lagooning was first introduced, it was thought that periodic sludge removal would be necessary. However, three sludge removal surveys in a 10 year period have failed to produce evidence that such sludge accumulation occurs. Problems associated with land application of lagoon liquor have been largely due to nitrates. It has been found that annual applications of less than 280 kg N ha-1 can be made on corn with little danger of groundwater pollution and minimal effects on plant tissue. Because anaerobic lagoons are sources of odor, they should be located at least 1 km from residences. Because these lagoons are temperature dependent, they are not recommended for cold climates. Anaerobic lagoons should be as deep as local conditions allow, usually 3-9 m. A loading rate of about 0.08 kg VS m-3day-1 is recommended. Purple sulphur-fixing bacteria control H2S odors and should be encouraged by seeding from other active lagoons. (Penrod-East Central)
W77-01531

DAIRY MANURE UTILIZATION AND FIELD APPLICATION RATES,
For primary bibliographic entry see Field 5B.
W77-01532

LIVESTOCK WASTE MANAGEMENT WITH POLLUTION CONTROL.
North Central Regional Research Publication 222, June, 1975, 89 p. 45 fig, 58 tab, 277 ref. $2.00. J. R. Miner and R. J. Smith, eds.

Descriptors: *Farm wastes, *Feed lots, Biological properties, Chemical properties, Physical properties, Separation techniques, Waste treatment, Byproducts, Transportation, Odor, Dusts, Agricultural runoff, Aerobic treatment, Anaerobic treatment, Recycling, *Waste treatment.
Identifiers: *Waste management, Land application, Refeeding.

The aspects of livestock waste management described in this report reflect the variations encountered across the 13 states of the North Central Region. The main objective of this report is to present information on waste management that will free a livestock producer from unnecessary labor, yet, at the same time, will allow him to operate within the confines of current environmental legislation. The NC-93 committee recognizes that such an objective alone is inadequate; hence, there are large sections of the report devoted to by-product recovery. The report summarizes the necessary features of any livestock-waste-management system and presents basic information on manure production and content. The effect of housing on livestock-waste management is discussed in terms of roofed facilities and unroofed facilities. Air pollution by gases and dust is regarded of such importance that one whole section is devoted to this topic. Conventional biological waste stabilization is discussed in two sections on aerobic and anaerobic treatment. The section on utilization attempts to analyze manure-processing technology for harvesting useful by-products. Some of the topics discussed include land application with crop production, hydroponics, composting, production of livestock feed supplements, and pyrolysis. The report culminates with two sections on information retrieval and technical terms encountered in livestock waste management. (East Central)
W77-01534

AGRICULTURAL WASTE MANAGEMENT FIELD MANUAL.
Soil Conservation Service, Washington, D. C.
August, 1975, 345 p. 63 fig, 55 tab.

Descriptors: Agriculture, *Legal aspects, *Regulation, *Water pollution, *Air pollution, *Water quality, *Waste water treatment, Solid wastes, Agricultural runoff, Chemical properties, Livestock, Poultry, Crop response, Geology, Fish, Liquid wastes, Solid wastes, Lagoons, Waste treatment, Waste storage waste disposal, Food processing wastes, Pesticides, Equipment, Monitoring, Sampling.
Identifiers: *Waste management, Land disposal.

This manual presents information, data, and guidelines for planning, designing, and operating agricultural waste management systems. It is intended for use by field offices of the U. S. Soil Conservation Service (SCS). It supplements but does not supersede national or state standards, specifications, or requirements of SCS as they pertain to various conservation practices. Topics considered are: (1) Laws, rules, and regulations, (2) Water quality, (3) Municipal waste water treatment, (4) Waste characteristics, (5) The role of soils in waste management, (6) The role of plants in waste management, (7) Geologic considerations in waste management, (8) Fish and wildlife aspects of waste management, (9) Livestock and poultry waste management systems, (10) Food processing waste management systems, (11) Land application of wastes, (12) Waste management system components, (14) Pesticides and other chemicals, (15) Waste management equipment, (16) Monitoring and Sampling. Conversion factors and tables are also supplied along with a glossary of terms. (Merryman-East Central)
W77-01535

WATER QUALITY AND MANAGEMENT CHARACTERISTICS OF FEEDLOT RUNOFF HOLDING PONDS,
Illinois Univ., at Urbana-Champaign. Dept. of Agricultural Engineering.
E. C. Dickey, and D. H. Vanderholm.
Presented at the 1975 Winter Meeting, American Society of Agricultural Engineers, Chicago, Illinois, December 15-18, 1975, Paper No. 75-4568, 12 p. 6 fig, 3 tab, 8 ref.

Descriptors: *Water quality, *Feed lots, *Agricultural runoff, *Illinois, Rainfall-runoff relationships, Nitrogen, Phosphorus, Potassium, *Farm wastes.
Identifiers: *Holding ponds, Land application.

A study was initiated in 1974 to evaluate installed runoff control facilities in terms of their management requirements, operator acceptability, and their effectiveness in preventing water pollution. Six commercial livestock operations in central and northern Illinois--beef, dairy, and swine facilities--were monitored for two years. This paper reports the findings directly related to characteristics and management of the holding ponds. Each runoff control system consisted of a concrete settling basin with a gravity-drain or a pumped outlet, holding pond, and pumping equipment for holding-pond dewatering. Rainfall and runoff data were collected at all the locations. Five holding ponds were sampled monthly; the sixth was sampled weekly. It was found that the quality of holding-pond water is highly variable. Large variations in nitrogen, phosphorus, and potassium concentrations in the water were observed. Nitrogen concentration exhibited a definite seasonal trend: low concentrations during the summer months, increasing in late fall and winter, reaching a peak in late winter, and decreasing in the spring. It was concluded that major factors affecting holding-pond water quality are the management of the lot surface, the number of animals in the system, and changes in annual rainfall patterns. In order to gain optimum nutrient benefits, dewatering of the holding pond should occur in the spring. However, dewatering in the fall is still recommended in most situations to provide capacity for winter runoff storage. (Cameron-East Central)
W77-01537

LIVESTOCK AND POULTRY WASTE DISPOSAL CONTROL,
North Carolina Agricultural Extension Service, Raleigh.
For primary bibliographic entry see Field 5G.
W77-01538

AN ECOLOGICAL BLUEPRINT FOR TODAY.
Journal of Environmental Health, Vol. 34, No. 1, p. 30-39, July-August, 1971. 6 fig, 3 tab, 3 ref.

Descriptors: *Waste disposal, Sampling, Chemical properties, Physical properties, *Farm wastes, Recycling, Application rates, *Waste treatment.
Identifiers: *Land disposal, *Spray irrigation.

The recycling of human effluent and animal waste by spray irrigation was discussed. Ten acres of cropland and 12 acres of woodland were spray irrigated. Disposal of liquid manure was at the rate of 2 in. per week over a 10-acre tract of cropland which is equivalent to 20 acre-in. or 544,000 gal. Weekly sampling and testing from 32 stations in the spray irrigation area were performed for the presence of turbidity, temperature, dissolved oxygen, phosphates, nitrates, nitrites, pH, ABS, and chlorides. It was found that by taking effluent from agricultural wastes of 200 cows and spray irrigating the crops with this effluent, production was tremendously improved. By utilization of the nutrients and the water, tonnage per acre increased. It was found that animals prefer nutrient-irrigated crops, as the plants are more succulent and contain more phosphorus and other minerals than crops that are just watered. The establishment of a community using spray irrigation for handling sewage waste was also described. Results so far indicate that spray irrigation is an effective system. The waste is applied to croplands and woodlands instead of dumping it into streams and lakes. (East Central)
W77-01548

MANAGEMENT AND CONTROL OF BEEF FEEDLOT WASTE,
For primary bibliographic entry see Field 5G.
W77-01550

5E. Ultimate Disposal Of Wastes

BURNING WASTES AT SEA--IF THE EPA APPROVES,
For primary bibliographic entry see Field 5G.
W77-01082

DEEP WELL WASTES MAY BE WATER HAZARDS.
For primary bibliographic entry see Field 5B.
W77-01083

SLUDGE,
For primary bibliographic entry see Field 5G.
W77-01085

CONDITIONING HIGHLY RADIOACTIVE SOLIDIFIED WASTE,
Gesellshaft fuer Kernforschung m.b.H., Karlsruhe (West Germany).
For primary bibliographic entry see Field 5D.
W77-01233

SOME SOIL HYDRAULIC CONSIDERATIONS IN LIQUID WASTE DISPOSAL,
Department of Agricultural Technical Services, Pretoria (South Africa).
D. J. Van Rooyen.
Water SA., Vol 1 (2), p 83-89, (1975). 4 fig, 2 tab, 13 ref.

Descriptors: *Soil hydraulic characteristics, *Waste water disposal, Filtration, Adsorption, Groundwater, Soils, *Soil disposal fields, Water pollution, Liquid wastes.
Identifiers: South Africa.

The disposal of wastewaters on land is very intimately related to the natural hydrologic cycle, and constitutes a man-made modification of that cycle. In carrying out plans for the disposal of wastewater on land, the greatest promise is held by approaches which act in co-operation with natural hydrologic phenomena, rather than by approaches which tend in the opposite direction. Soil disposal of liquid wastes can only be considered to be satisfactory if effluent infiltrates in sufficient quantities and if processes of filtration and adsorption will purify the liquid before it can be recycled. Soil hydraulic parameters pertinent to the problem and which have a sound physical basis, have been considered in preference to empirical soil-water-relations. Both field and laboratory measurements were made of saturated and unsaturated flow regimes. These were followed by the evaluation of theoretical flow models on significant South African soils. Comparisons of the results were made in order to assess the validity of the various approaches. (South Africa)
W77-01354

URBAN SOLID WASTES ENGINEERING,
Johannesburg City Engineer's Dept. (South Africa).
V. Bolitho.
The Civil Engineer in South Africa, Vol 16 (11), p 329-341, (1974), 4 fig, 9 tab.

Descriptors: *Solid wastes, Legislation, *Waste disposal, Waste reuse, *Domestic wastes.
Identifiers: South Africa.

The collection and disposal of urban solid wastes is one of the most important yet most neglected aspects of urban engineering. The problem is complex and the operation inherently expensive. The paper defines the wastes problem, describes the essential elements of a collection and disposal system, deals with recycling of wastes, emphasizes the need for legislation and explains why the problem requires the urgent attention of engineers. (South Africa)
W77-01379

THE ECONOMICS OF HANDLING SOLID WASTES (DIE EKONOMIE VAN SOLIEDE AFVALHANTERING),
National Inst. for Water Research, Pretoria (South Africa).
For primary bibliographic entry see Field 5D.
W77-01461

SOLID-WASTES RECYCLING: APPREHENSIONS, MISAPPREHENSIONS AND DILEMMAS,
Johannesburg City Engineers Dept. (South Africa).
For primary bibliographic entry see Field 5D.
W77-01484

LIVESTOCK WASTE MANAGEMENT WITH POLLUTION CONTROL.
For primary bibliographic entry see Field 5D.
W77-01534

AGRICULTURAL WASTE MANAGEMENT FIELD MANUAL.
Soil Conservation Service, Washington, D. C.
For primary bibliographic entry see Field 5D.
W77-01535

DISPOSAL OF BEEF FEEDLOT MANURE,
Texas Agricultural Experiment Station, College Station.
D. L. Reddell, and P. Lyerly.
Progress Report PR-3279C, September, 1975. 5 fig, 19 tab, 21 ref.

Descriptors: *Waste disposal, *Crop response, *Water pollution, *Groundwater, *Agricultural runoff, *Nutrients, *Soil profiles, Odor, Nitrates, Cultivation, *Farm wastes.
Identifiers: *Land disposal.

Research was conducted at the Texas Agricultural Experiment Station in El Paso to study the following: (1) the ability of various tillage equipment to plow under up to 900 tons per acre of manure and cover with sufficient soil to eliminate odors, (2) deep plowing disposal techniques for possible pollution of surface water and (3) crop quality and yields from deep plowed field plots receiving large manure application rates. In May, 1970, beef manure was deep plowed into Vinton fine sandy loam at rates of 0, 300, and 900 tons per acre wet basis. Pollution level of irrigation runoff increased with manure application rate immediately following application, but rapidly decreased to background levels within a couple of months. Soil solution extracts taken from the unsaturated manure disposal plots indicated an increase in ammonium, organic-nitrogen, COD, sodium and chloride with manure application rate. These chemical constituents peaked and in most cases were decreasing by August, 1972. Ground water samples revealed an increase in chemical constituents with manure application rate. Concentrations peaked during 1971 and reduced to background levels by August, 1972. Although significant levels of nitrate accumulate in the soils receiving large manure application, no detrimental

nitrate level occurred in groundwater samples. Denitrification must have prevented this. Yields of corn silage and forage sorghum that were grown on plots receiving up to 900 tons per acre of manure were diminished the first year. However, yields increased during the second and third years. Nitrate levels in these crops were below the nitrate toxicity levels for feeding livestock. Nitrate levels of forage grown on the 300-ton per acre plots and the 900-ton per acre plots were comparable. (Penrod-East Central)
W77-01536

LIVESTOCK AND POULTRY WASTE DISPOSAL CONTROL,
North Carolina Agricultural Extension Service, Raleigh.
For primary bibliographic entry see Field 5G.
W77-01538

LAND SPREADING OF MANURE FROM ANIMAL PRODUCTION UNITS,
Newcastle-upon-Tyne Univ. (England). Dept. of Agricultural Engineering.
J. R. O'Callaghan, K. A. Pollock, and V. A. Dodd.
Journal of Agricultural Engineering Research, Vol. 16, No. 3, p. 280-300, September, 1971. 6 fig, 13 tab, 22 ref.

Descriptors: *Computer models, *Waste disposal, *Fertilizers, Cattle, Water pollution, Farm wastes, Hogs.
Identifiers: *Land disposal, *Loading rates, Hydraulic loading, Chemical loading.

A computer simulation model has been developed to determine manure output for a group of pigs as a function of diet. The results of this model are incorporated into a second model designed to simulate land spreading of the manure. One of the factors to be considered in land spreading is the hydraulic loading of the soil; this is assessed by comparing actual evapotranspiration with historical rainfall figures and allowing the manure to make up any soil moisture deficiency. Chemical loading is determined by assessing the levels of nitrogen, potassium, and phosphorus that will be removed by the crop or fixed in the soil. Any excess applied over this figure will result in groundwater or runoff contamination. Because of increased soil saturation and decreased organic activity in cold weather, spreading during winter months is not advisable. The farmer should never apply more slurry to the soil than can be immediately absorbed. Crops also affect the maximum permissible chemical loading; intensive grass production permits the maximum loading. To plan a waste disposal system, levels of manure output and its chemical composition must be established. The hydraulic and chemical loading maximums for each field and each crop will allow the minimum acreage required for waste disposal to be calculated. By avoiding the need to purchase fertilizer, the farmer can realize cash value from his manure. For example, if a farmer fattens 5,000 hogs per year, the total cash value of the nitrogen, potassium, and phosphorus content of the manure would be 5000 pounds sterling, with spreading costs of about 1,700 pounds sterling. (East Central)
W77-01544

AN ECOLOGICAL BLUEPRINT FOR TODAY.
For primary bibliographic entry see Field 5D.
W77-01548

5F. Water Treatment and Quality Alteration

METHOD FOR USING MACROAMINE POLYMERS AS FLOCCULATING AGENTS,
Chemical (B. R.), Co. Ltd., Tokyo (Japan). (Assignee).
For primary bibliographic entry see Field 5D.
W77-01218

ULTRAVIOLET WATER PURIFIER,
D. N. Lambert, and R. H. Bennett.
U.S. Patent No. 3,971,947, 5 p, 4 fig, 5 ref; Official Gazette of the United States Patent Office, Vol 948, No 4, p 1579, July 27, 1976.

Descriptors: *Patents, *Water treatment, *Water purification, *Water quality control, *Ultraviolet radiation, Disinfection, Equipment, *Waste water treatment.
Identifiers: Germicidal effects.

An ultraviolet water purifier has a number of ultraviolet lamps mounted in a cover which extends over the purifier and above the water. A parabolic reflector directs the rays of the lamps toward the body of water. The purifier is provided with a water inlet and a baffle adjacent to it having an opening at its base to compel the water entering the purifier to flow downward and then to flow through a filter. Air bubbles are trapped by a second baffle extending from the cover to below the water level. Before the water is discharged from the purifier, a third baffle which is positioned in approximately the center of the purifier and of lower height than the body of water compels the water to flow to the surface and over the third baffle to be discharged at the end of the purifier opposite that of the inlet thereby exposing the water to the rays of the ultraviolet lamps for a maximum period and at the position at which the rays are most effective as a germicide. (Sinha-OEIS)
W77-01234

VIRUSES IN WATER, (VIRUSSE IN WATER), (IN AFRIKAANS),
Pretoria Univ. (South Africa). Dept. of Microbiology.
For primary bibliographic entry see Field 5A.
W77-01481

WONDERFUL WATER (WONDERLIKE WATER), (IN AFRIKAANS),
For primary bibliographic entry see Field 2K.
W77-01486

THE EPIDEMIOLOGY OF RECLAIMED WATER,
South West African Inst. for Medical Research, Windhoek.
For primary bibliographic entry see Field 5D.
W77-01492

5G. Water Quality Control

AN EXPLORATORY STUDY OF POSSIBLE ENERGY SAVINGS AS A RESULT OF WATER CONSERVATION PRACTICES,
Oklahoma Univ., Norman. Bureau of Water and Environmental Resources Research.
For primary bibliographic entry see Field 3E.
W77-01052

RESEARCH TO DEVELOP ECOLOGICAL STANDARDS FOR WATER RESOURCES,
Oklahoma Univ., Norman. Bureau of Water and Environmental Resources Research.
For primary bibliographic entry see Field 6G.
W77-01054

FUTURE DIRECTION OF URBAN WATER MODELS,
Water Resources Engineers, Inc. Walnut Creek, Calif.
M. B. Sonnen, L. A. Roesner, and R. P. Shubinski.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-249 049, Price code: A05 in paper copy, A01 in microfiche. Environmental Protection Agency, Report EPA-600/2-76-058, February 1976. 86 p, 7 fig, 2 tab, 161 ref. 68-03-0499.

Descriptors: *Model studies, *Mathematical models, Analytical techniques, *Simulation, *Runoff, *Sewage systems, Computer models, Hydrologic models, Waste water treatment, Urban runoff, Rainfall.
Identifiers: *Urban watershed management.

An evaluation of the future direction of urban water management modeling is presented. Current models are reviewed, and points of possible interface between hydrologic models and models of treatment or control facilities are suggested. Conclusions are: subsystems should be simulated before attempting simulation or formal optimization of connected subsystems; model users should be trained and informed as to model limitations and applicability, and developers should include simplifications in order to reduce the past and current problem of poor communication between users and developers; systematic expansion into other urban water subsystems besides urban runoff, sewer systems and receiving waters should be undertaken when developing analytic tools. Recommendations are: models should be immediately developed in the areas of runoff transport modeling, real-time control technology for combined sewer systems, and receiving water quality-economics models; later model development should include a reclamation/reuse routing model for quantities and qualities of urban water, a long-period ecologic model for receiving waters and an improved runoff quality smulation model. (Gentry-North Carolina)
W77-01071

STATE REGULATION OF COASTAL WATER AREA PRESERVES,
Miami Univ., Fla., School of Law.
For primary bibliographic entry see Field 6E.
W77-01072

BETTER THAN BEST: A CROSSCURRENT IN THE FEDERAL WATER POLLUTION CONTROL ACT AMENDMENTS OF 1972,
Cook Coll., New Brunswick, N.J.
W. Goldfarb.
Land and Water Law Review, Vol 11, p 1-26 (1976), 27 p.

Descriptors: *Federal Water Pollution Control Act, *Water quality standards, *Water pollution treatment, *Legislation, *Effluents, Rivers, Water pollution, Water law, Industrial wastes, Standards, Federal government, Administrative agencies, Agricultural runoff, Urban runoff, Storm runoff, Thermal pollution, Electric power plants, Law enforcement, Regulation, Waste treatment, Waste water(Pollution), Water cooling, Technology.
Identifiers: *FWPCA Amendments of 1972, Congressional hearings, Administrative regulations.

Prior to 1972, federal water pollution control law was based on stream use classification and water quality standards. Enforcement was difficult since it was seldom possible to pinpoint the discharger responsible for lowered water quality. The Federal Water Pollution Control Act Amendments of 1972 rely primarily on uniform national effluent limitations rather than state standards. The goals of the act are to achieve water of swimmable quality by 1983 and zero discharge by 1985. The author maintains that a basic conflict exists in that the best technology economically available is not sufficient to attain swimmable water quality. Industries will be forced to utilize tecnology that is 'better than best' with undesirable results. He recommends amending the act to provide that a cost-benefit analysis be made before 'better than best' technology is required. A second problem with the act is in the area of thermal pollution. Stating that cooling towers may produce worse environmental

problems than discharge of heated water does, the author again suggests that a cost-benefit analysis be applied to thermal pollution standards. (Capehart-Florida)
W77-01073

RECENT DEVELOPMENTS IN THE LAW OF THE SEA: A SYNOPSIS,
For primary bibliographic entry see Field 6E.
W77-01075

THE NATIONAL PERMIT PROGRAM: A POLLUTER'S BRIDGE OVER TROUBLED WATERS,
J. T. Bernbom.
Loyola University Law Journal, Vol 7, p 1-31 (Winter 1976), 31 p.

Descriptors: *Federal Water Pollution Control Act, *Rivers and Harbors Act, *Remedies, *Law enforcement, *Regulation, Judicial decisions, Penalties(Legal), Water quality control, Water quality standards, Effluents, Federal jurisdiction, State jurisdiction, Permits, Water law.
Identifiers: *FWPCA Amendments of 1972, *Licenses, *Nuisance(Legal aspects), Estoppel.

When the Federal Water Pollution Control Act amendments of 1972 were enacted, a permit system was established for control of pollution. The permit requires compliance with federal discharge limitations and is issued by a federal agency only after state certification that state standards have also been met. The amendments provide that compliance with permit terms is deemed to give immunity from certain enforcement actions, although not all. For example, the Rivers and Harbors Act of 1899, and the Refuse Act both provideviable enforcement actions to prohibit discharges into navigable waters despite the immunities amendment. In addition, other actions to enforce oil spill prohibitions apparently survive. While a variety of estoppel and jurisdictional arguments may be made, permittees may find themselves subject to federal common law nuisance, state nuisance and state statutory enforcement of stricter pollution standards. (Comer-Florida)
W77-01076

BURNING WASTES AT SEA--IF THE EPA APPROVES,
Business Week, No 2420, p 86R, February 23, 1976. 1 p, 1 photo.

Descriptors: *Ships, *Waste disposal, *Water pollution control, *Oceans, *Incineration, Burning, Environmental effects, Administrative agencies, Disposal, Oxidation, Wastes, Solid wastes, Ultimate disposal, Smoke, Costs, Cost analysis.
Identifiers: *Incineration ships.

Ocean dumping of wastes is plainly unacceptable to many environmentalists. Large dead areas of the ocean have been reported by Jacques Cousteau and others. However, there is presently in existance an environmentally superior method that is currently gaining acceptance in the United States. Waste-burning ships have been used in Europe for some time, and the Environmental Protection Agency (EPA) has just concluded tests on the feasibility of incineration at sea. It was found that there was no evidence of harm to fish or bird life in the vicinity of a burn. Shell Oil Company tried it and found that it worked, with slightly higher costs than ocean dumping. The EPA, which delayed and hampered Shell's first trials with administrative red tape, seems ready to permit other companies to use the system without any interference. Problems include the cost of waste storage for some time and transportation, often in specially made containers. Nevertheless, in an ever-increasing climate of hostility to ocean-dumping, incineration at sea seems to be a viable alternative. (Frank-Florida)
W77-01082

OF SLIME AND THE RIVER,
For primary bibliographic entry see Field 5B.
W77-01084

SLUDGE,
T. Kidder.
Atlantic, Vol 235, p 62-68, 70, April 1975. 8 p.

Descriptors: *Land use, *Sewage sludge, *Sludge disposal, *Oceans, *Water pollution treatment, Water pollution, Disposal, Waste disposal, Waste treatment, Municipal wastes, Land reclamation, Wastes, Chemical degradation, Biodegradation, New York, Hudson River, Beaches.
Identifiers: *Coastal waters.

Sludge is the end result of much of America's pollution treatment activities. Presently, cities like New York, Boston and Philadelphia are dumping their sludge into offshore waters. A twenty square mile area called the New York Bight is really no more than a dead sea. While mid-western cities like Chicago, Milwaukee, and Houston were laying their sludge productively on land to act as a soil conditioner, these eastern cities were killing large ocean areas. It seems probable that within the next few years the mass of sludge will reach the south shore of Long Island, closing down its beaches for public bathing, perhaps permanently. The solution must come from land deposits. Even though land disposal of sludge is costly, it is better than destroying fish life and plankton resources. However, it should be noted that the Environmental Protection Agency has just approved newer and deeper areas for ocean sludge dumping. (Frank-Florida)
W77-01085

URBAN STORM WATER RUNOFF: A TWOFOLD PROBLEM,
Florida Univ., Gainesville. School of Law.
For primary bibliographic entry see Field 6E.
W77-01098

COUNTY AND MUNICIPAL POLLUTION CONTROL FACILITIES.
For primary bibliographic entry see Field 6E.
W77-01108

STATE EX REL BROWN V ROCKSIDE RECLAMATION (STATUTE PROVIDING FOR GRANTING OF PERMITS RELATING TO WATER POLLUTION CONTROL--APPLICATION).
For primary bibliographic entry see Field 6E.
W77-01114

NAVIGABLE WATERS (DEFINITION, ENUMERATION AND OFFENSES).
For primary bibliographic entry see Field 6E.
W77-01120

WATER POLLUTION PROHIBITED.
For primary bibliographic entry see Field 6E.
W77-01121

POLLUTION OF NAVIGABLE WATERS.
For primary bibliographic entry see Field 6E.
W77-01122

MILLER ANTI-POLLUTION ACT OF 1971 (ABSOLUTE LIABILITY OF PETROLEUM CARRIER).
For primary bibliographic entry see Field 6E.
W77-01123

THE ATTITUDE AND INTEREST OF THE ENVIRONMENTAL PROTECTION AGENCY IN MULTIPLE OBJECTIVE PLANNING OF WATER AND RELATED LAND RESOURCES,
Environmental Protection Agency, Washington, D.C. Office of Water Planning and Standards.
A. J. Erickson.
In: Multiple Objective Planning for Water Resources, Volume 1, Proceedings of the UCOWR Workshop on Multiple Objective Planning and Decision-Making, Natural Resources Series Number 5, Idaho Research Foundation, Inc., Moscow, 1974.

Descriptors: *Attitudes, *Planning, *Water resources, Land resources, Water quality, Management, River basin development, Waste treatment, Regional development, Economics, Social aspects, U.S. Water Resources Council.
Identifiers: *Multiple objective planning, Water programs, Cost-effectiveness.

This short paper provides a perspective of the relationships between water quality management planning, as it is being fostered, guided and assisted by the Environmental Protection Agency, and the multiple objective planning concepts identified in the 'Principles and Standards' put forth by the Water Resources Council. First is an indication of the EPA planning program, second the role of NEPA 1969, and finally the relationship to other water and related land resources planning. (See also W76-11123) (Bell-Cornell)
W77-01153

EMERGING CORPS OF ENGINEERS GUIDELINES FOR IMPLEMENTING THE PLANNING REQUIREMENTS OF WRC'S PRINCIPLES AND STANDARDS AND RELATED POLICIES,
Corps of Engineers, Washington, D.C. Planning Div.
For primary bibliographic entry see Field 6B.
W77-01154

WATER SALVAGE POTENTIALS IN UTAH, VOLUME II, EVAPORATION SUPPRESSION BY RESERVOIR DESTRATIFICATION,
Utah Water Research Lab., Logan.
For primary bibliographic entry see Field 2D.
W77-01164

A SOLUTION PROCEDURE FOR THE DESIGN PROBLEM OF A MULTIPLE TREATMENT PLANT SYSTEM ALONG A STREAM,
McGill Univ., Montreal (Quebec). Dept. of Civil Engineering and Applied Mechanics.
For primary bibliographic entry see Field 5D.
W77-01165

POLLUTER DISCRIMINANT ANALYSIS,
Krannert Graduate School of Industrial Administration, Lafayette, Ind.
D. G. Tock, and G. P. Wright.
Water Resources Research, Vol. 12, No. 4, p 613-616, August 1976. 1 fig, 3 tab, 3 ref.

Descriptors: *Water pollution control, *Data collections, Coasts, Great Lakes, Statistical methods, Mathematical models, Systems analysis.
Identifiers: *Discriminant analysis, Polluters.

A unique water pollution data base for the U.S. coastal waterways and Great Lakes that has been evolving since 1965 is discussed. The pollution statistics in this data base are used to develop a model, employing multiple discriminant techniques, to determine which pollution incident report variables will discriminate the polluter who reports his spill from the polluter who does not report his spill. The results of the analysis indicate that as few as nine out of a possible sixty variables provide reasonable discriminatory power. (Bell-Cornell)
W77-01166

EVALUATING ENVIRONMENTAL QUALITY MANAGEMENT PROGRAMMES IN WHICH DISCHARGERS ARE GROUPED,
Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.
E. D. Brill, Jr., J. C. Liebman, and C. S. ReVelle.
Applied Mathematical Modelling, Vol. 1, No. 2, p 77-82, September 1976. 3 fig, 1 tab, 8 ref.

Descriptors: *Environment, *Quality control, *Management, *Evaluation, Optimization, Methodology, Algorithms, Effluents, Linear programming, Marginal costs, Water quality, Constraints, Standards, Computer programs, Mathematical models, Equations, Systems analysis.
Identifiers: Delaware estuary, Cost minimization, Non-linear formulations, Non-linear branch-and-bound procedure.

Much attention is being directed internationally to evaluating alternative programs for environmental quality management. Presented is an approach to evaluating some of the management programs in which dischargers are divided into groups and treated in a similar fashion within each group. The emphasis is on finding efficient programs for a particular geographic region where ambient environmental quality standards are used. Analogous non-linear mathematical formulations are presented for direct regulation and effluent charge programs, and a non-linear branch-and-bound solution procedure is described. A detailed algorithm is described for the effluent charge case; it is shown to be very practical in an application to data for the Delaware estuary. (Bell-Cornell)
W77-01170

ECOSYSTEM MODELS AND ENVIRONMENTAL POLICY,
San Diego State Univ., Calif. Center for Regional Environmental Studies.
For primary bibliographic entry see Field 6G.
W77-01172

NON-POINT SOURCE CONTRIBUTIONS TO WATER QUALITY PROBLEMS,
Waterloo Univ. (Ontario). Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W77-01173

THE MODELLING AND CONTROL OF POLLUTION IN A RIVER SYSTEM,
Cambridge Univ. (England). Dept. of Engineering.
For primary bibliographic entry see Field 5B.
W77-01175

WATER QUALITY CONTROL UNDER UNCERTAINTY: OPTIMAL STOPPING RULES FOR SAMPLING,
Arizona Univ., Tucson. Dept. of Systems and Industrial Engineering.
L. Duckstein, C. C. Kisiel, and M. Beckmann.
Journal of Hydrology, Vol. 28, No. 2/4, p 331-342, February 1976. (Published in Amsterdam) 1 fig, 1 tab, 7 ref.

Descriptors: *Water quality control, *Sampling, *Water resources, *Methodology, *Optimization, Biochemical oxygen demand, Constraints, Economics, Stochastic processes, Farms, Irrigation, Salinity, Equations, Systems analysis, Mathematical models, *Risks.
Identifiers: *Stopping rules, Data networks.

One of the functions of water data networks is surveillance and control of water quality. Budgetary constraints reduce the scope of data sampling such that uncertainty about water quality parameters is a consequence. This paper considers the problem of using limited resources to control the sampling of a pollutant, such as biochemical oxygen demand (BOD), in a stream or other water bodies. In this case, BOD would be the state variable. Optimal stopping rules for sampling are developed under the constraints; such rules are desirable because of shifting social uses of the water body. The methodology recognizes that future data networks must be flexible, economical and reliable in the information they generate. The proposed formulation, which stems from modifying existing models, may be a useful framework for controlling the quality of a river or an aquifer (even air quality). An example of controlling the salinity of irrigation water taken from an available source with randomly varying salt concentration points the way toward another possible range of applications. (Bell-Cornell)
W77-01176

THE SAINT JOHN RIVER SYSTEM MODELS: A CASE STUDY,
Department of the Environment, Ottawa (Ontario). Ecological Systems Research Div.
A. K. Biswas.
Journal of Hydrology, Vol. 28, No. 2/4, p 393-406, February 1976. (Published in Amsterdam) 4 fig, 13 ref.

Descriptors: *Water resources, *River systems, *Water pollution control, *Environmental control, *Linear programming, *Simulation analysis, Optimization, Decision making, Planning, Mathematical models, Systems analysis.
Identifiers: *Saint John River(New Brunswick Canada), Policy planning.

There is an increasing awareness that with our past preoccupation with economic growth we have not given enough importance to the quality of the environment, a vital concern for water resources management. This awareness has manifested itself in the water pollution field and has precipitated the urgen necessity for developing new and better techniques to improve the quality of decisions being made in this area. A promising technique is the application of systems analysis to water resources policy planning andecision making. This article considers the state-of-the-art in mathematical modeling in this field. Discussed are models of the Saint John River System in Canada. Considered is the study area's geography and industry; the use of linear programming and simulation models is described. It is concluded that better understanding of the physical processes involved with water quality management and development of more powerful computer technology and better algorithms during the last decade or so have enables us to analyze more complex systems by means of mathematical models, thus enabling more accurate decisions. (Bell-Cornell)
W77-01178

THE GROUND WATER LEGAL REGIME AS INSTRUMENT OF POLICY OBJECTIVES AND MANAGEMENT REQUIREMENTS,
City Univ. of New York.
For primary bibliographic entry see Field 6E.
W77-01181

A SUBURBAN MODEL OF RATIONAL GROUND WATER UTILIZATION: A PLAN FOR NASSAU COUNTY,
City Univ. of New York.
For primary bibliographic entry see Field 4B.
W77-01182

COAL AND THE ENVIRONMENT, ABSTRACT SERIES, MINE DRAINAGE BIBLIOGRAPHY, 1910-1976.
Bituminous Coal Research, Inc., Monroeville, Pa.
September 30, 1976, 288 p. Compiled by V. E. Gleason and H. H. Russell EPA Grant 803189.

Descriptors: *Water pollution control, *Mine drainage, *Bibliographies, *Abstracts, Acid mine water, *Mine wastes, Mine water, *Coal mine wastes, Strip mine wastes.

This bibliography of 1,285 references has been prepared by Bituminous Coal Research, Inc., and National Coal Association, with sponsorship of the Pennsylvania Department of Environmental Resources and the United States Environmental Protection Agency. This volume will be significantly easier to handle than the eleven separate issues which had become an unwieldly reference tool. Entries from the previously published Mine Drainage Abstracts which are directly related to water pollution resulting from mining and preparation of coal are repeated here. In addition, this volume has been updated with the inclusion of literature from 1975 and 1976 and also with newly acquired items published earlier but not previously listed in the bibliographies. The subject areas of material listed in the bibliography cover surface and underground mines, active and abandoned mines, reclaimed surface mines, and planning of new mines. Also included are information on lakes formed by surface mining, drainage from coal refuse disposal areas, and water from coal preparation plants. A large number of items are concerned with effects of mine drainage on rivers and streams. In addition to the abstracts, this volume includes an Author Index and a General Index.
W77-01192

WET COOLING TOWER WITH PLUME ELIMINATOR,
Westinghouse Electric Corp., Pittsburgh, Pa. (Assignee).
J. O. Stephens.
U. S. Patent No. 3,965,672, 5 p, 3 fig, 3 ref; Official Gazette of the United States Patent Office, Vol 947, No 5, p 1942, June 29, 1976.

Descriptors: *Patents, *Cooling towers, *Water vapor, Temperature, Velocity, Mixing, Engineering structures, Powerplants, Equipment.
Identifiers: Plumes, *Wet cooling towers.

Wet cooling towers, where the circulating water is brought into direct contact with the air, under many weather conditions produce a plume. This can be both a nuisance and a problem, even though it is essentially pure water, as it often causes local fogging and icing conditions on nearby roadways in winter months. In order to eliminate the plume the cooling tower is encircled by an exhaust header. The exhaust header is in fluid contact with the exhaust of the gas turbines which supply hot gases to the header. A number of exhaust conduits are inclined upward and are generally placed tangentially with respect to a circle in the cooling tower to thoroughly mix the hot exhaust gases with the moisture laden air, increasing its temperature and velocity so that as the effluent mixture emerges from the upper end of the cooling tower its buoyancy and velocity are sufficient to cause it to rise into the upper atmosphere, and under most weather conditions the effluent does not produce a visible plume. (Sinha-OEIS)
W77-01193

OIL OR ORGANIC SOLVENT-ABSORBENT,
Teijin Ltd., Osalin (Japan). (Assignee).
A. Omori, I. Okamura, T. Imoto, and T. Katoh.
U.S. Patent No. 3,966,597, 8 p, 4 fig, 2 tab, 12 ref; Official Gazette of the United States Patent Office, Vol 947, No 5, p 2244, June 29, 1976.

Descriptors: *Patents, *Oil pollution, *Water quality control, *Waste water treatment, *Water pollution treatment, Absorption, Solvents, *Separation techniques, Plastics, Polymers.

A description is given for an oil or organic solvent-absorbent for absorbing or removing oils which have flowed onto the surfaces of the sea or rivers or other bodies of water; for absorbing or removing waste oils discharged from industrial establishments; or for absorbing or removing oil or organic solvent which has flowed onto any water surface or is present in waste water in a floating,

suspended or dissolved state. It was found that a blend of polystyrene and polyethylene is highly suitable. First an unopened, sheetlike and reticulated fibrous structure is made from the resinous blend. Then the blend is admixed with a foaming agent in the molten state. The resulting molten mixture is extruded through a die, quenched at the die exit to a temperature below the glass transition temperature of the blend, and drafted at a draft ratio of from the maximum draft ration possible under the operating conditions to one-third the maximum draft ratio. The sheet-formed fibrous structures thus obtained possess numerous noncontinuous cracks or splits along the direction of drafting. Two of the unopened, sheet-formed and reticulated fibrous structures may be superposed with the directions of their cracks conformed to each other, pulled in the direction perpendicular to the direction of fibers and extended. This sheet can be used as an absorbent for oils or various organic solvents. (Sinha-OEIS)
W77-01200

APPARATUS FOR SPILLING RETRIEVAL,
W. P. Kirk, and D. W. Reynolds.
U.S. Patent No. 3,966,613, 10 p, 12 fig, 13 ref; Official Gazette of the United States Patent Office, Vol 947, No 5, p 2250, June 29, 1976.

Descriptors: *Patents, *Oil pollution, *Oil spills, Water pollution sources, Water pollution treatment, Water pollution control, *Water quality control, Skimming, Separation techniques.
Identifiers: Containment, Catamarans, Oil retrieval.

The invention relates generally to the art of recovering floating liquids, particularly oil slicks or spillings from tankers and barges in open water. An apparatus is provided for collecting floating liquid spillings which may be pumped into tanks or confined within retrieval sheets. A vessel is provided that functions not only to deploy the sheet retrieval means but also to scoop up and concentrate a quantity of the spilling before deploying the sheet. The invention comprises a catamaran construction with spaced parallel hulls and bow and stern gates between the hulls forming a well. Each of the gates is supported by the hulls for independent pivotal movement. The gates are operated in conjunction with the sweeping movement of the catamaran through a body of water. A feature of the deployment well is the use of an air bubble barrier around its periphery to assist in concentrating the spilling toward the center of the well. The catamaran has a storage deck adjacent the deployment well. A jib crane is located in position to deliver the retrieval means to the deployment well as needed. Variable ballast means are adapted to change the draft of the catamaran according to its weight in order to ensure an optimum draft during the sweeping operation. (Sinha-OEIS)
W77-01202

OIL SPILL CLEANUP SYSTEM,
Shell Oil Co., Houston, Tex. (Assignee).
R. R. Ayers.
U.S. Patent No. 3,966,614, 11 p, 14 fig, 11 ref; Official Gazette of the United States Patent Office, Vol 947, No 5, p 2251, June 29, 1976.

Descriptors: *Patents, *Oil pollution, *Oil spills, Water pollution sources, Water pollution treatment, *Water pollution control, *Water quality control, *Skimming, Equipment, Separation techniques.
Identifiers: Containment, Oil retrieval.

A skimmer for removing oil from the surface of a body of water is articulated from front to rear to be wave comformable and/or has a quiescent collection zone formed by bottom and/or forward baffles. A flexible skimming head for use with or independently of the skimmer is composed of a foraminous sheet having an integral chevron flow pattern on its upper surface. A floating skimming head for use similar to the preceding head has a central, axially vertically movable cone or other configuration forming a suction mouth. A boom for use with or independently of the skimmer is composed of converging double booms. Storage capacity for oil collected by the skimmer is composed of onboard and/or offboard membranes. The baffles which divide the open front end of the skimmer into separate adjacent chambers open at front and rear to permit passage of oil and water and are of sufficient length to substantially arrest orbital water particle motion associated with waves without substantially impeding flow. They also act to diffuse and downward direct water exiting from the compartment and act to create a quescent oil capture zone within the compartment. (Sinha-OEIS)
W77-01203

OIL COLLECTION BARGE,
S. L. Petchul, and R. K. Petchul.
U.S. Patent No. 3,966,615, 5 p, 4 fig, 9 ref; Official Gazette of the United States Patent Office, Vol 947, No 5, p 2251, June 29, 1976.

Descriptors: *Patents, *Oil pollution, *Oil spills, Water pollution sources, *Water pollution control, Water pollution treatment, *Water quality control, Skimming, *Barges, Separation techniques, Equipment.
Identifiers: Oil collection, Containment.

The oil collection barge is a device which is intended for use in cleaning up oil spills and is especially useful where ultra large spills and adverse sea states are concerned. The device is capable of covering large areas quickly while it deals with the sea state and forces the oil floating in the path of the barge into the channel where the oil is not only contained but also rapidly concentrated. As a result of this initial concentration of the oil slick the actual separation process is made more efficient. The oil collection equipment and devices consist of a longtudinal U shaped channel with an adjustable water and oil intake funnel or wave dampner at the forward end, an oil blockage wall at the rear, an adjustable flow splitter at the rear, a water vent at the rear bottom and an adjustable vent plate at the rear bottom such that the water enters through the funnel, flows through the channel, and flows out the vent. The oil being lighter than water will enter through the funnel, flow aft in the channel, and be trapped by the blockage wall and channel sides while the water will flow through. The trapped oil is removed from the channel surface and is transferred to a holding tank by means of a spill gate, a floating suction bell and pump, or any other suitable means. (Sinha-OEIS)
W77-01204

APPARATUS FOR COLLECTING OIL SLICK FROM A BODY OF WATER,
E. A. De Voss.
U. S. Patent No. 3,968,041, 20 p, 27 fig, 14 ref; Official Gazette of the United States Patent Office, Vol 938, No 1, p 250, July 6, 1976.

Descriptors: *Patents, *Oil pollution, *Oil spills, Water pollution sources, Water pollution treatment, *Water pollution control, *Water quality control, Conveyance structures, Adhesion, Separation techniques.
Identifiers: Oil slicks, Endless belts, Artificial grass.

A system for removing oil slicks from water surfaces such as the ocean, harbors, lakes or ponds uses an endless conveyor, for example, the surface of a drum or of a belt. The surface contacts the oil slick which adheres to it. The slick is conveyed by the conveyor to a means for its removal such as a wringer. The invention uses a flexible, relatively limber, flat blade-like cover for the conveyor such as the well-known artificial grass 'Astroturf'. The conveyor overhangs and presses against the top of the oil slick to that the oil can adhere to the conveyor. A second convey on aft of the first conveyor extends below the elevation of the first conveyor so that they form a wedge-shaped path in which the oil tends to be trapped and drawn. The system can be mounted to floating support means and for moving it along the oil slick. (Sinha-OEIS)
W77-01211

FLOATING SKIMMER FOR CLEANING THE SURFACE OF A BODY OF LIQUID, METHOD AND APPARATUS,
D. J. Gore.
U. S. Patent No. 3,970,556, 10 p, 8 fig, 11 ref; Official Gazette of the United States Patent Office, Vol 948, No 3, p 1100, July 20, 1976.

Descriptors: *Patents, Water pollution treatment, *Water pollution control, *Water quality control, Water pollution sources, *Skimming, Floating, Floats, Weirs, Films, Separation techniques.
Identifiers: *Skimmers, Air-borne pollutants.

The majority of the dirt and debris that gets into a body of water is airborne. Water has a surface tension which tends to retain most of this airborne dirt and debris in a relatively tough film on the very upper surface. A floating skimmer which is manually controlled to remove this contaminated film is described. The skimmer comprises an outer ring shaped body having an inner, central cavity. A flotation and ballast chamber is formed integrally in the outer body. An inlet opening in one peripheral part of the outer body admits a flow of liquid into the central cavity. The liquid in the cavity is pumped through a drain opening in the base plate. A movable weir extends across the width of the inlet opening. It is connected to the outer body along its outer edge by a hinge connection which permits articulation to regulate the quantity of and velocity liquid flowing through the opening and into the central cavity. A float on the bottom of the weir rides on the liquid within the central cavity and adjusts the level of the weir in relation to the height of the external liquid. The incoming water flowing through the opening must therefore flow over the inclined weir, and it falls off the back, inner edge of the weir in a cascade action. By maintaining the weir at the proper height, the incoming water is accelerated, and the waterfall or cascade effectively pulls the upper film from the water. Because of the acceleration produced by the inclined weir, the skimmer very quickly cleans the entire water surface around the skimmer. (Sinha-OEIS)
W77-01228

OIL FENCE,
Mitsubishi Electric Mfg. Co. Ltd., Amagasaki (Japan). (Assignee).
T. Kinase, I. Yano, K. Okubo, H. Kitakoga, and H. Tayama.
U. S. Patent No. 3,971,220, 9 p, 19 fig, 7 ref; Official Gazette of the United States Patent Office, Vol 948, No 4, p 1342, July 27, 1976.

Descriptors: *Patents, *Oil pollution, *Water pollution control, *Water quality control, *Barriers, Floating, Structures, Equipment, *Separation techniques.
Identifiers: Oil fences, Containment.

An oil fence is described which has in combination, a longitudinally elongated, shielding screen member of flexible material; a number of rigid reinforcing strips placed at predetermined intervals on the screen member; one split float unit placed on the screen member about each of the reinforcing strips; sinkers placed at one of the longitudinal edges of the screen member through its length; and a length of reinforcing rope placed on the surface of the screen member to extend longitudinally. An improved take up apparatus is used for housing and spreading the oil fence in a simple manner and high efficiency. A box-like chamber

with attached buoys has a take-up shaft on which the oil fence can be coiled or uncoiled. (Sinha-OEIS)
W77-01230

ARE HOVERCRAFT A MAJOR CAUSE OF DISTURBANCES TO INERTIDAL INVERTEBRATES,
Institute of Terrestrial Ecology, Norwich (England). Colney Research Station.
For primary bibliographic entry see Field 6G.
W77-01263

THE COST-EFFECTIVENESS APPROACH IN ANALYZING A WATER SUPPLY PROJECT FOR THE SANTA ELENA PENINSULA, ECUADOR,
Arizona Univ., Tucson. Dept.of Hydrology and Water Resources.
For primary bibliographic entry see Field 6B.
W77-01270

SULFURIC ACID FOR THE TREATMENT OF AMMONIATED IRRIGATION WATER: II. REDUCING CALCIUM PRECIPITATION AND SODIUM HAZARD,
New Mexico State Univ., Las Cruces. Dept. of Agronomy.
S. Miyamoto, and J. Ryan.
Soil Science Society of America, Journal, Vol. 40, p 305-309, 1976. 1 fig, 6 tab, 13 ref.

Descriptors: *Irrigation operation and maintenance, *Hydrogen sulfide, *Mine wastes, *Irrigation efficiency, Water utilization, Water quality, Southwest U.S., Infiltration, Ammonia, Lime, Chemical wastes, Industrial wastes, Pollution abatement, Fertilizers.

Effects of the application of ammonia and sulfuric acid to ammoniated water on Calcium precipitation and Na-Hazard of irrigation water are evaluated theoretically, using known relations of ion equilibria, and tested with laboratory and greenhouse experiments. Results show severe precipitation of Ca2+ when ammonia is applied to alkaline irrigation water. Ammonia application also increases exchangeable Na and NH4, and can reduce water infiltration rates, especially when irrigation waters contain high Na+ relative to Mg2+ and Ca2+. Sulfuric acid applied to ammoniated water neutralizes OH- produced by ammonia application, reducing Ca precipitation and exchangeable Na. This prevents a decline in infiltration rates. Sulfuric acid, now available as a pollution abatement byproduct in the Southwest, can be used for correcting excessive lime incrustation or poor water penetration induced by the use of anhydrous or aqua ammonia without corroding irrigation systems. (Jamail-Arizona)
W77-01286

MECHANICAL CONTROL OF EURASIAN WATERMILFOIL IN MARYLAND WITH AND WITHOUT 2,4-D APPLICATION,
Maryland Univ., Solomons. Chesapeake Biological Lab.
For primary bibliographic entry see Field 4A.
W77-01289

COOPERATIVE CONTROL OF INTERNATIONAL POLLUTION AND COMMON PROPERTY RESOURCES,
University of Western Ontario, London.
J. R. Markusen.
Quarterly Journal of Economics, Vol. 89, No. 4, p. 618-632, 1975. 1 fig., 1 tab., 7 ref.

Descriptors: *Pollution abatement, *Mathematical models, *Foreign countries, *Welfare(Economics), Environmental control, Cost repayment, Taxes, Government finance, Tariff.
Identifiers: *Common property resources, *Transnational pollution, Public goods, Transfer payments.

Described is an economic model that incorporates externalities between countries and regions arising from the existence of common property resources, e.g., fisheries, oil fields, and mineral deposits lying beyond respective territorial limits, and pollution. The model represents a national policy to maximize a social welfare function with the assumption that the only tools available to this government are tariffs and subsidies. The model then attempts to solve and interpret a set of prerequisite conditions that must be satisfied by an optimal tax structure when the tax-imposing country behaves in an uncooperative fashion toward foreign planners. Then the dependence and interaction between two countries in the presence of such a bilateral externality are analyzed. The objective is to define a type of cooperative behavior and compare it to the noncooperative behavior. Of particular interest is the relationship between the set of allocations resulting from the cooperative behavior and the set of allocations that are Pareto-efficient from the world's point of view. The major finding is that a cooperative imposition of national production taxes, or any other form of cooperative output adjustment, will not guarantee Pareto efficiency, but there does exist a transfer payment in connection with a cooperative tax adjustment that will produce a Pareto solution. (Auen-Wisconsin)
W77-01290

GUIDELINES FOR LAKE WATERSHED MANAGEMENT PLANNING.
Maine Dept. of Environmental Protection, Augusta. Bureau of Water Quality Control.
Pilot Lakes Study, April 1976. 201 p. 19 fig, 10 tab, 46 ref, 4 append.

Descriptors: *Planning, *Watershed management, *Land use, *Methodology, Water quality control, Eutrophication, Evaluation, *Maine, Data collections, Phosphorus, Carrying capacity, Statistical methods, Computer programs, Environmental effects, Economic efficiency, Constraints, Competing uses, Feasibility, Social aspects, Economic impact, Institutions, Input-output analysis.
Identifiers: *User manual, Case study, Phosphorus load, Real estate development, State-of-the-art.

Information essential to planning, with the principal goal of water quality protection or improvement through control of water and related land uses, is presented. Detailed are procedures for determining goals and objectives and application of standard or improved tools and techniques. The planning process is initiated with an inventory of natural and cultural features of two Maine watersheds. Aerial photographic interpretation was complemented by on-site investigations to identify the nature and extent of natural resources and existing user patterns. A computerized data system, RIMPS (Resource Inventory Management Planning System), was developed to assist storage, retrieval and analysis of geographically oriented information. Black and white, low-level, aerial stereo photographs were used to develop a graphic base and ultimately stored in the computer. Techniques are detailed for various combinations of land and water resource elements to determine the natural suitability for particular uses and compared with existing uses to determine the current capacity for specified uses. Recommendations for corrective action are illustrated, with estimates of costs vs. benefits. Measured economic and other resource variables were combined with the assistance of RIMPS and a Trophic State Index to assess their implications for maintaining and improving water quality. Assessment of the lake as an economic resource, synthesized with water and land use suitabilities and development capacity, becomes the basis for lake watershed management plans and institutional needs. (Auen-Wisconsin)
W77-01291

COFFEE POND WATERSHED MANAGEMENT PLAN.
Maine Dept. of Environmental Protection, Augusta. Bureau of Water Quality Control.
Pilot Lakes Study, April 1976. 95 p. 29 fig., 48 tab., 26 ref.

Descriptors: *Planning, *Watershed management, *Land use, *Water quality control, *Methodology, Eutrophication, Evaluation, *Maine, Data collections, Phosphorus, Carrying capacity, Statistical methods, Computer programs, Environmental effects, Economic efficiency, Constraints, Competing uses, Feasibility, Social aspects, Economic impact, Institutions.
Identifiers: *Residential development, *Coffee Pond watershed(Maine), Pilot study, Phosphorus load.

Management procedures developed by Maine's pilot study program demonstrate standard methods for planning a lake watershed as focused on Coffee Pond and the future development of single-family, detached residential dwellings using cellars and on-site wastewater disposal subject to the constraint that lake water quality (as indicated by phosphorus loading only) should not be degraded beyond a pre-determined level. It is stressed that this is a demonstration of standard methods and is neither designed nor intended to present a comprehensive plan for watershed management. Inventory analyses techniques similar to those described should also be applied to such issues as industrial or recreational development, development or roads and utilities, control of land use, etc. And constraints other than water quality to be considered are community growth goals, economics, conservation of open space, etc. The data base utilized the RIMPS (Resource Inventory Management Planning System) computer programs and the input included terrestrial features, climate, limnology of Coffee Pond, cultural features, including existing land and water uses; economic data included demographic factors, industries, dwellings and commercial property, and undeveloped property; and an institutional overview. The environmental impact of the development, the carrying capacity, and the feasibility as related to social, economic, and institutional factors of the watershed are also analyzed. (Auen-Wisconsin)
W77-01292

FOREST LAKE WATERSHED MANAGEMENT PLAN.
Maine Dept. of Environmental Protection, Augusta. Bureau of Water Quality.
Pilot Lakes Study, April 1976. 92 p. 31 fig., 40 tab., 26 ref.

Descriptors: *Planning, *Watershed management, *Land use, *Methodology, *Water quality control, Eutrophication, Evaluation, *Maine, Data collections, Phosphorus, Carrying capacity, Statistical methods, Computer programs, Environmental effects, Economic efficiency, Constraints, Competing uses, Feasibility, Social aspects, Economic impact, Institutions.
Identifiers: *Residential development, *Forest Lake(Maine), Pilot study, Phosphorus load.

A demonstration watershed management plan, developed by a Maine pilot study and applied to Forest Lake, presents examples of procedures and results of a planning process. The intention is to only demonstrate the standard methods developed for the pilot program and is not designed as a comprehensive management plan. The framework for the evaluation and analysis focused on the suitability and capacity for the development of single-family, detached residential dwellings using cellars and on-site wastewater disposal subject to the constraint that the lake water quality (as determined by phosphorus loading only) should not be degraded beyond pre-determined level. This planning guideline considered the watershed's natural features, including fisheries and wildlife;

existing land uses such as transportation, recreation, dwellings, industries, agriculture, and forestry; existing water uses for recreation, manufacturing, agriculture, and service industries; the economic base, including value of dwellings, commercial property, service industries, manufacturing, and undeveloped property; demographic factors; and an analysis of institutional structures. Based on the foregoing data an analysis assessed the watershed's development suitability, its carrying capacity, its feasibility, and economic value. Economic and other resource variables were combined with the assistance of RIMPS (Resource Inventory Management Planning System) computer programs and other planning tools. (Auen-Wisconsin)
W77-01293

RESOURCE INVENTORY MANAGEMENT PLANNING SYSTEM (RIMPS). USER MANUAL,
Jordan (Edward C.), Inc., Portland, Maine.
C. S. Stees, R. E. Blake, and T. J. Churchill.
Maine Dept. of Environmental Protection, Pilot Lakes Study, Appendix I, March 1976. 104 p. 23 fig., 4 ref., 2 append.

Descriptors: *Computer programs, *Land use, *Planning, *Methodology, Data storage and retrieval, Mapping, *Maine, Water quality control.
Identifiers: RIMPS Computer program.

RIMPS is a computer software package which performs planning functions to enable the user to inventory natural resources, demographic characteristics, and economic data within a defined area. It displays inventoried data graphically and to scale, provides a means for ascertaining land use suitability within natural and cultural constrants, and enables the user to identify conflicts between existing or proposed land uses and the suitability for these uses. It also provides a means for determining preferred land uses. RIMPS is composed of five computer programs labeled LANDCP (Ind code), IRR (irregular outline), DATA (data file), GRID-1 (grid or map), and ATTR-2 (attractiveness program). LANDCP, IRR and DATA read in and store inventoried resource characteristics data on the computer; these programs create the data files for use in the GRID and ATTR programs. The GRID program creates a map of the stored data, and depending upon usage, stores the map for further use or prints out the map as the program executes. ATTR essentially provides the user with the ability to develop land use planning alternatives in a 'gaming' format. This manual gives the detailed procedure for using RIMPS. RIMPS hardware requirements are currently limited to disk drives, 250k memory and FORTRAN language suited to the Control Data Cybernet System. (Auen-Wisconsin)
W77-01294

TOXICITY INDEX FOR PERMITS,
National Field Investigations Center-Denver, Colo.
For primary bibliographic entry see Field 5A.
W77-01321

AVAILABILITY OF WATER FOR COAL CONVERSION,
Bureau of Reclamation, Billings, Mont. Upper Missouri Region.
For primary bibliographic entry see Field 3E.
W77-01345

ENVIRONMENTAL DATA MANAGEMENT,
For primary bibliographic entry see Field 6G.
W77-01347

WATER CONFLICTS IN WESTERN COAL DEVELOPMENT,
Montana State Univ., Bozeman. Dept. of Civil Engineering and Engineering Mechanics.
For primary bibliographic entry see Field 3E.
W77-01349

A LABORATORY EVALUATION OF A DYE FOR THE CONTROL OF ALAGAL GROWTH,
National Inst. for Water Research, Pretoria (South Africa).
R. D. Walmsley, W. E. Scott, and D. F. Toerien.
Water SA, Vol 1(2), p 90-92, (1975). 2 fig, 3 tab, 7 ref.

Descriptors: Algae, Aquatic weed control, Light penetration, *Dyes, *Growth rates.
Identifiers: South Africa, *Anacystis nidulans, *Selenastrum capricornutum, *Algal growth control.

The principle of the use of a dye for the control of algal growth was investigated at the laboratory scale. The commercial dye employed was shown to have little effect on the growth rates of Anacystis nidulans and Selenastrum capricornutum in the laboratory at concentrations above the recommended doses. Experiments using 200 l tanks also substantiated this lack of effect on mixed phytoplankton populations. It is suggested that a dye with absorption characteristics closer to those of algal pigments might be more effectual for algal growth control. (South Africa)
W77-01355

A COMPARISON OF OIL AND FLIT MLO FOR CATCH BASIN TREATMENT,
Middlesex County Mosquito Extermination Commission, Metuchen, N. J.
R. Schmidt, E. Evans, and D. J. Sutherland.
Mosq News. 33(4), p 585-587, 1973.

Descriptors: *Insecticides, Watersheds(Basins), *Pest control, *Insect control, *Pesticides, *Oil.
Identifiers: *Culex-pipiens, *Flit-MLO.

Flit MLO performed satisfactorily in controlling Culex pipiens L. breeding in catch basins when applied at the rate of 1 oz/basin. The use of Flit MLO was slightly more economical than the use of fuel oil.--Copyright 1974, Biological Abstracts, Inc.
W77-01357

METALS IN URBAN DRAINAGE SYSTEMS AND THEIR EFFECT ON THE POTENTIAL REUSE OF PURIFIED SEWAGE,
National Inst. for Water Research, Pretoria (South Africa).
For primary bibliographic entry see Field 5D.
W77-01362

URBAN SOLID WASTES ENGINEERING,
Johannesburg City Engineer's Dept. (South Africa).
For primary bibliographic entry see Field 5E.
W77-01379

CATCHMENT RESEARCH AT ZACHARIASHOEK,
Jonkershoek Forest Research Station, Stellenbosch (South Africa).
For primary bibliographic entry see Field 4D.
W77-01386

OIL-SPILL DISPERSANT FOR MARINE POLLUTION (LEKOLIEDISPERGEERMIDDEL VIR SEEBESOEDELING).
South African Bureau of Standards, Pretoria.
SABS-BULLETIN, Vol 4, (4), p 68-72, (1974).

Descriptors: *Oil pollution, *Oil spills, Beaches, Standards, *Dispersion, Toxicity, Lethal limit, *Water quality standards.
Identifiers: *South Africa.

A description is given of the first specifications for oil spill dispersant for use in dispersing crude and fuel oil floating on sea water, as well as for use in beach cleaning compiled by the South African Bureau of Standards. The specification lays special stress on dispersing efficiency, suitability for use in spray equipment and toxicity to marine life. The specification also makes provision for prohibited ingredients, such as benzines, chlorinated hydrocarbons, phenols, creosols, free caustic alkalis, mineral acids, while other requirements include consistency, flash point, cloud point, viscosity and corrosiveness. Provision has also been made for compatibility of the dispersant with other dispersants. (South Africa) (In Afrikaans and English)
W77-01387

A SANITARY ENGINEER'S VIEWPOINT ON THE DESIGN, INSTALLATION, MAINTENANCE AND COST OF SANITARY DRAINAGE SYSTEMS IN HIGH-RISE BUILDINGS,
For primary bibliographic entry see Field 8A.
W77-01388

KERBS AND CHANNELS,
National Physical Research Lab. Pretoria (South Africa).
For primary bibliographic entry see Field 8F.
W77-01389

FERTI-IRRIGATION - APPLICATION OF FERTILISER MATERIALS BY MEANS OF MICRO-IRRIGATION SYSTEMS - PART 1,
Stellenbosch Univ. (South Africa). Dept. of Soil Science.
For primary bibliographic entry see Field 3F.
W77-01393

FERTI-IRRIGATION-APPLICATION OF FERTILISER MATERIALS BY MEANS OF MICRO-IRRIGATION SYSTEMS - PART 2,
Stellenbosch Univ. (South Africa). Dept. of Soil Science.
For primary bibliographic entry see Field 3F.
W77-01394

LEAF ANALYSIS PROVES USEFUL IN INCREASING EFFICIENCY OF NITROGEN FERTILIZATION OF ORANGES AND REDUCING NITRATE POLLUTION POTENTIAL,
California Univ., Riverside. Dept. of Plant Sciences.
T. W. Embleton, W. W. Jones, and R. L. Branson.
Commun Soil Sci Plant Anal. 5(5), p 437-442, 1974.

Descriptors: *Nitrogen, Oranges, *Water pollution control, *Analytical techniques, *Leaves, *Fertilizers, *Pollutant identification.

In some areas in California N usage is now less than half of what it was prior to 1960. The reduction was associated with increased commercial usage of leaf analysis as a guide to N fertilization. Since 1960, as a result of the decrease in fertilizer applied, the annual per-acre amounts of fertilizer N that were subject to leaching in the Santa Ana Watershed were reduced by an estimated 50% in Riverside County and about 80% in San Bernardino County.--Copyright 1975, Biological Abstracts, Inc.
W77-01434

WATER RECLAMATION - QUALITY TARGETS AND ECONOMIC CONSIDERATIONS,
National Inst. for Water Research, Pretoria (South Africa).
For primary bibliographic entry see Field 5D.
W77-01440

SOIL-WATER-PLANT RELATIONSHIPS - IMPORTANT DESIGN CRITERIA FOR IRRIGA-

TION-PLANNING, (GROND-PLANT-WATER-VERHOUDINGS AS BELANGRIKE ONTWERP-GEGEWENS VIR BESPROEIING-SBEPLANNING),
Stellenbosch Univ. (South Africa). Dept. of Agriculture.
For primary bibliographic entry see Field 3C.
W77-01454

ENRICHMENT WILL MAKE US POORER, (VERRYKKING GAAN ONS ARMER MAAK),
National Inst. for Water Research, Pretoria, (South Africa).
D. F. Toerien.
Public Health, Vol. 76(3), p 87-93, (1975).

Descriptors: Eutrophication, Algae, Nutrients, Sedimentation, Nitrogen, Phosphorus, Oxygen, Oxygen demand, Fishkill, Sewage effluents, Industrial wastes.
Identifiers: South Africa, Vaal River, Hartebeespoort Dam, Rietvlei Dam, Roodeplaat Dam.

The problems of eutrophication in South African dams are discussed. Due to millions of litres of nutrient enriched effluents being released into rivers and streams eventually to be impounded in a number of large dams in and around the industrial heart of South Africa algae and water weeds flourish in these impoundments to the extent of making the water undesirable as raw water for drinking purposes or for recreational use. (South Africa)
W77-01456

A CASE FOR RECLAMATION,
National Inst. for Water Research, Pretoria (South Africa).
For primary bibliographic entry see Field 5D.
W77-01458

POLLUTION, MAN, HIS ENVIRONMENT AND THE PHYSICIST, (BESOEDELING, DIE MENS, SY OMGEWING EN DIE FISIKUS),
A. Strasheim.
Geneeskunde, Vol 17(1), p 9-15, (1975). 4 fig, 4 tab, 32 ref.

Descriptors: Air pollution, Water pollution, Dispersion, Fluorescence, Carbon monoxide, Mercury, Lead, Sea water, Freshwater, Canada, United States, Absorption, Pollutant identification, Environment.
Identifiers: South Africa.

As environmental pollution is becoming a greater threat to man, knowledge of control mechanisms are becoming more important. The following points are discussed: (1) pollutants originating from motor vehicles; (2) spread of pollutants; (3) the determination of lead in blood by using the atomic fluorescence technique. (South Africa)
W77-01482

CONTROL OF WATER POLLUTION - A HIDDEN RESOURCE, (BEHEER OOR WATER-BESOEDELING - 'N VERBORGE HULPBRON),
Department of Water Affairs, Pretoria (South Africa).
R. T. Rudd.
The Civil Engineer in South Africa, Vol 17 (12), p 317-320, (1975).

Descriptors: Environmental effects, *Water pollution control, *Pollution abatement, *Natural resources, Recycling, Industrial wastes.
Identifiers: *South Africa, *Industrial wastes recovery.

Effective water pollution control embraces more than just supervision over the purification of polluted water. Pollution abatement in the fullest sense implies more efficient use of natural resources. The industries of South Africa are described as they occur in certain defined regions. Present methods of pollution abatement are discussed as well as trends toward the better utilization of raw materials which could result in higher production coupled with less pollution. Conversion of wastes to useful products and research work in this connection are mentioned. (South Africa)
W77-01489

THE EFFECT OF TWO COMMERCIAL HERBICIDES ON THE SETTLEMENT, GERMINATION AND GROWTH OF ENTEROMORPHA,
Newcastle-upon-Tyne Univ. (England). Dept. of Plant Biology.
For primary bibliographic entry see Field 5C.
W77-01503

RULES AND REGULATIONS: CONFINED FEEDING OPERATIONS.
Iowa Department of Environmental Quality, Water Quality Commission, 1971, 4 p.

Descriptors: *Regulation, *Iowa, *Waste water disposal, *Water pollution control, *Farm wastes, Feedlots, Water quality standards.
Identifiers: *Open feedlot, *Confinement feeding operation, Registration.

An open feedlot (unroofed or partially roofed adjacent or nearby animal enclosures on a single property) is defined in terms of specific animal populations and population densities. Confinement feeding operations (roofed or partially roofed adjacent or nearby animal enclosures on a single property from which wastes are removed as a liquid or semi-liquid) are defined in terms of maximum number of animals confined at one time. These data are given for beef cattle, dairy cattle, swine, sheep, turkeys, and chickens. Conditions requiring registration are outlined along with requirements for the facilities and for operation of the facilities. Feedlot pollution control facilities constructed in accordance with rules in effect at the time of construction shall not be required to be reconstructed due to subsequent rule changes unless the commission finds that waste discharge from such facilities is causing water pollution. Such facilities shall, however, be brought into compliance with rules in effect at the time of reconstructing, enlarging or otherwise modifying the confined feeding operations or control facilities. (Merryman-East Central)
W77-01512

SULFURIC ACID FOR THE TREATMENT OF AMMONIATED IRRIGATION WATER: I. REDUCING AMMONIA VOLATILIZATION,
Arizona Univ., Tucson. Dept. of Soils, Water and Engineering.
S. Miyamoto, J. Ryan, and J. L. Stroehlein.
Soil Science Society of America Proceedings, Vol. 39, No. 3, p 544-548, May-June 1975. 4 fig, 7 tab, 11 ref.

Descriptors: *Irrigated water, *Ammonia, *Ammonification, Water quality, Fertilizers, Fertilization, Acids, Waste disposal, Water pollution control, Waste water treatment.
Identifiers: *Sulfuric acid, *Ammonia volatilization reduction.

Effects of sulfuric acid applied to ammoniated irrigation waters on ammonia volatile losses are analyzed theoretically and evaluated by laboratory and field experiments. Volatile loss of ammonia from irrigation waters is directly related to the concentration of NH4OH. Sulfuric acid application reduces the concentration of NH4OH relative to the total N applied as anhydrous or aqua ammonia, principally by lowering pH. This consequently reduces ammonia volatile loss, e.g., by as much as 50% when acid is applied at rates equivalent to ammonia. The reduction of ammonia loss by sulfuric acid application through forming HNH4SO4- is nil. Simultaneous application of acid and ammonia may serve as a practical means of controlling ammonia loss as well as disposing of large quantities of projected surplus acid without reducing pH of irrigation water. (Skogerboe-Colo St)
W77-01517

PROSPECTS OF HYDROMETRY IN THE LIGHT OF MODERN TECHNOLOGY,
International Commission on Irrigation and Drainage, New Delhi (India).
For primary bibliographic entry see Field 7B.
W77-01519

PROCEEDINGS OF CONFERENCE ON FARM ANIMAL WASTES: 'FARMER EXPERIENCES, CODES, GUIDELINES, RESEARCH PROGRESS, EQUIPMENT'.
Wisconsin Univ.-Madison. Cooperative Extension Programs.
Stevens Point, Wisconsin, February 9-10, 1972. 63 p. R. E. Graves, ed.

Descriptors: *Regulation, *Legal aspects, *Farm wastes, *Equipment, Water pollution, Air pollution, Public health, Agricultural runoff, Confinement pens, Liquid wastes, Dairy industry, Waste storage, Drying, Irrigation, Lagoons, Wisconsin, Ducks.
Identifiers: *Waste management, Cost sharing, Land disposal.

This conference focused on the proposed Wisconsin code on animal wastes existing and proposed manure handling guidelines, farmer experience with various manure handling methods and systems and equipment that industry has availed today. Conference objectives were: (1) To give farmers, industry and public agencies who have pioneered new waste handling systems a chance to tell their story, (2) To review the contents of animal waste regulations proposed for Wisconsin and their implications, (3) To develop discussion of present and future guidelines for handling animal wastes, (4) To consider the adequacy of research, handling systems and equipment, current programs for animal waste management, and (5) To further discussion and communication among individuals, groups and agencies who have an interest and concern in this area. (See W77-01522 thru W77-01527) (Merryman-East Central)
W77-01521

A REVIEW OF THE POLLUTION ABATEMENT SITUATION IN INDUSTRY, MUNICIPALITIES AND GOVERNMENT,
Environmental Protection Agency, Washington, D. C. Office of Solid Waste Management Programs.
T. W. Bendixen.
In: Proceedings of Farm Animal Waste Conference 'Farmer Experiences, Codes, Guidelines, Research Progress, Equipment', Stevens Point, Wisconsin, February 9-10, 1972, p. 5-9.

Descriptors: *Water pollution, *Air pollution, *Regulation, Liquid wastes, Solid wastes.

Mr. Bendixen reviews activities and programs of the Federal government related to pollution abatement. Among regulations reviewed are: (1) the Clean Air Amendment of 1970, (2) the Refuse Act of 1899, and (3) the Federal Water Pollution Control Act. Geographical coverage, variation in local conditions, varying assimilative capacities of water bodies and nature and interaction of pollutants complicate any attempt to accurately rank sources as to severity or to show trends of water pollution. However, using biochemical oxygen demand as the criterion, many people feel that industrial wastes are the largest source of organic water pollutants nationwide; then municipal wastes; then agricultural wastes. Environmental improvement is a task of all the people, and every segment of

society, whether it be cities, towns, industry, agriculture, business or governmental activities. (See also W77-01521) (Merryman-East Central)
W77-01522

A REVIEW OF ANIMAL WASTE REGULATIONS AROUND THE NATION,
D. G. Last.
In: Proceedings of Farm Animal Waste Conference 'Farmer Experiences, Codes, Guidelines, Research Progress, Equipment', Stevens Point, Wisconsin, February 9-10, 1972, p. 10-15.

Descriptors: *Water pollution, *Regulation, Design, Pollution abatement, *Farm wastes.

Modern agriculture contributes a variety of quality degrading substances to our waterways. In particular livestock operations have been singled out as being a threat to water quality. It may be noted that regardless of whether a state has a specific law governing animal waste storage, transport, or disposal, all states, since the passage of the Water Quality Act in 1965, are required by federal law to have approved water quality standards. Such standards list minimum acceptable BOD levels, bacteria counts, etc. for each water body. These standards can be used to bring about a cease and desist order against a livestock owner or operator. A number of states have gone one step further and enacted animal waste pollution legislation. Approximately 14 states have present or proposed laws dealing with feedlot construction and/or operation. Eighteen states and several provinces of Canada have or are proposing specific animal waste regulations. An inventory of the states having specific animal waste control regulations reveals a great deal of difference in the content of the regulations. Many of the animal waste codes contain in or outside the body of rules, some statement of purpose, intent, or objective. Nearly every code has a definitions section. Most of the rules contain information on water pollution abatement facilities. They establish a procedure for determining the need for such facilities, their design requirements, operation and upkeep. Another common feature of animal waste regulation is some form of permit system. The enforcement of the regulations may be handled either through a state natural resources commission or a state health agency. (See also W77-01521) (Merryman-East Central)
W77-01523

POLLUTION ABATEMENT IN WISCONSIN, HISTORICAL DEVELOPMENT AND PRESENT STATUS,
Wisconsin Div. of Environmental Protection, Stevens Point.
O. D. Williams.
In: Proceedings of Farm Animal Waste Conference 'Farmer Experiences, Codes, Guidelines, Research Progress, Equipment', Stevens Point, Wisconsin, February 9-10, 1972, p. 16-20.

Descriptors: *Regulation, *Air pollution, *Water pollution control, *Wisconsin, *Pollution abatement.

Pollution problems and attempts at pollution abatement from colonial days to the present are discussed, citing specific pollution problems and regulations. This is background for speeches to come later which deal with the proposed Animal Waste Rules. (See also W77-01521) (Merryman-East Central)
W77-01524

ANIMAL WASTE PROBLEMS NOW FACING THE DEPARTMENT OF NATURAL RESOURCES,
Wisconsin Dept. of Natural Resources, Madison. Industrial Waste Water Section.
P. P. Didier.
In: Proceedings of Farm Animal Waste Conference 'Farmer Experiences, Codes, Guidelines, Research Progress, Equipment', Stevens Point, Wisconsin, February 9-10, 1972, p. 21-28. 3 fig.

Descriptors: *Regulation, *Water pollution, *Wisconsin, Waste storage, Waste disposal, Agricultural runoff, *Farm wastes.

The Wisconsin Department of Natural Resources' statutory authority and responsibilities in relation to water pollution and more specifically as related to animal wastes are reviewed. Various types of agricultural pollution are pinpointed. Manure management problems include: manure storage and disposal, the need for manure management alternatives, feedlot runoff, and livestock destroying banks of unfenced streams. Regulatory, advisory and cost sharing agencies must be coordinated to solve these problems. Any solution to the animal waste management problem will involve a mix of programs, combining regulation, research, education, financial assistance, voluntary actions by the farmer himself and even tolerance on the part of the non-farming population. (See also W77-01521) (Merryman-East Central)
W77-01525

PROPOSED ANIMAL WASTE REGULATIONS FOR WISCONSIN,
Wisconsin Univ., Madison. Dept. of Soil Science.
M. Beatty.
In: Proceedings of Farm Animal Waste Conference 'Farmer Experiences, Codes, Guidelines, Research Progress, Equipment', Stevens Point, Wisconsin, February 9-10, 1972, p. 32-36.

Descriptors: *Regulation, *Agricultural runoff, *Waste storage, *Wisconsin, Water pollution control, Water pollution sources, *Farm wastes.
Identifiers: *Waste management, Land spreading.

Background is given on how the ad hoc committee on agricultural waste pollution operated and how the animal waste rules were developed. Some of the major provisions of the rules are discussed. The rules begin with definitions of terms. The rules focus on water pollution. They give standards for systems of manure storage and handling. Plans for storage ponds and retention ponds must be reviewed by the Department of Natural Resources. The rules require plans for large operations, those that are greater than 800 animal units, to be submitted to the Department of Natural Resources for review. If manure is spread in the winter and no erosion control program is used, the spreading must be back a minimum of 200 feet from streams, lakes, ditches and ponds. The rules concentrate on point sources. Streams, lakes and ponds must be fenced out of the barnyards by 1975; and the runoff from animal lots and enclosures must be controlled so that the manure won't simply go under the fence and into a stream. A feedlot operator must have a minimum land area under his control for spreading of manure. One-third of an acre per animal unit for dairy, beef, swine, and sheep, and half an acre per animal unit for birds are the minimum areas suggested. The problem of odors is not dealt with due to their subjective nature. (See also W77-01521) (Merryman-East Central)
W77-01526

DEPARTMENT OF NATURAL RESOURCES PROPOSED ANIMAL WASTE MANAGEMENT RULES.
Wisconsin Dept. of Natural Resources, Madison.
In: Proceedings of Farm Animal Waste Conference 'Farmer Experiences, Codes, Guidelines, Research Progress, Equipment', Stevens Point, Wisconsin, February 9-10, 1972, p. 40-44.

Descriptors: *Regulation, *Waste storage, *Waste disposal, *Waste treatment, *Agricultural runoff, *Wisconsin, Water pollution, *Farm wastes.
Identifiers: Inspection.

The Proposed Animal Waste Management Rules are given. The preamble states that when wastes from agricultural activities impair water quality, systematic prevention or remedial action is required. The proposed rules establish standards and define procedures whereby the state can protect the public interest in maintaining the quality of water in Wisconsin. The recycling of animal wastes to the land and the continued development of new and innovative systems are encouraged. Coordination of the efforts of regulatory, educational, technical, and financial assistance program of other governmental agencies is also encouraged. Further technical development is necessary before rules controlling odors can be formulated. The Department of Natural Resources will continue to handle odor complaints individually and will promote further study of the problem. The rules will be periodically reviewed and, when necessary, revised to reflect advancing technologies of agricultural production and environmental protection. Outlined in the proposed rules are: (1) Definition, (2) Collection, storage and disposal of animal wastes, (3) Treatment of animal wastes, (4) Runoff control (animal shelters, enclosures and lots), (5) Filing of reports, plans and specifications, (6) Violations and enforcement, (7) Hearings, orders and appeals, (8) Inspection, (9) Limitations, (10) Severability, and (11) Applicability and effective date. (See also W77-01521) (Merryman-East Central)
W77-01527

MANURE DISPOSAL, POLLUTION CONTROL, AND THE NEW YORK DAIRY FARMER,
Cornell Univ., Ithaca, N. Y. Dept. of Agronomy.
For primary bibliographic entry see Field 5D.
W77-01528

IMPLICATIONS OF EPA PROPOSED REGULATIONS OF NOVEMBER 20, 1975 FOR THE ANIMAL FEEDING INDUSTRIES,
Department of Agriculture, Washington, D. C. Animal Waste Subcommittee.
January 30, 1976, 39 p. 21 tab.

Descriptors: *Regulations, *Economics, *Water pollution sources, *Feed lots, Livestock, *Farm wastes.
Identifiers: *National Pollutant Discharge Elimination System, Waste management.

The Environmental Protection Agency's National Pollutant Discharge Elimination System (NPDES) proposed regulations of November 20, 1975, for livestock operations could require an estimated 94,500 operations to apply for permits. The information contained in this report is based on expert opinion (not surveys) of USDA and State research and extension personnel located in major livestock producing States and was not available when EPA proposed the regulations. Of the estimated 94,500 operations affected by NPDES regulations--manmade waste conveyance, navigable water traversing the operation, and large operations--there are 14,000 beef, 32,000 dairy and 48,500 swine operations. In addition an estimated 250 turkey range operations would be affected. Estimates indicate that less than 4 percent of the operations that would be affected have capacities of more than 300 animal unit equivalents (300 beef animals, 750 swine and 210 dairy cows). Over 70 percent of the operations judged to be affected had capacities of less than 100 beef animals, 250 swine and 70 dairy cows. In order to comply with the proposed regulations, it is likely that affected operations would have to install systems to control discharges. Additional investments to install these systems would amount to about $205 million. For an additional 10 percent of the operations, the least-cost method of meeting proposed regulations would be to relocate the operation. The estimated 94,500 operations affected account for 20 percent of total fed beef marketings, 19 percent of milk sales, and 11 percent of hogs and pigs marketed. The proposed regulations contain a further provi-

sion for identifying a 'concentrated animal feeding'. This provision allows for 'case-by-case' designation of additional operations, regardless of size, that must apply for an NPDES permit, but the factors determining the outcome of these determinations are not listed in the proposed regulations. (Merryman-East Central)
W77-01529

LIVESTOCK AND POULTRY WASTE DISPOSAL CONTROL,
North Carolina Agricultural Extension Service, Raleigh.
G. Kriz.
Circular 556, February, 1973, 8 p.

Descriptors: *Air pollution, *Water pollution, *North Carolina, *Regulation, Waste disposal, Waste treatment, Feed lots, *Farm wastes.
Identifiers: *Waste management, *Land disposal.

Questions on air and water pollution control for livestock and poultry wastes are answered in this publication by the North Carolina Agricultural Extension Service. Areas of pollution control covered, include (1) Definitions of pollution and nuisance according to North Carolina Law, (2) Factors which determine how animal wastes become a nuisance or cause pollution, (3) Responsibilities of various state agencies, (4) Regulations--local, state or federal--that apply to animal waste disposal, (5) Services provided by the Board of Water and Air Resources, and (6) Assistance that is provided to animal producers by agencies, conservation services and agricultural departments in pollution control and prevention. Conditions affecting pollution potential of animal wastes, methods of animal waste management and land application rates are discussed. Final questions are answered that examine (1) where responsibility lies in insuring that pollution does not result from an animal operation, (2) methods for avoiding pollution when a production unit continues at the same level and (3) methods for avoiding pollution when a production unit either expands or builds a new facility. (Penrod-East Central)
W77-01538

THE EDITOR'S NOTEBOOK: ABOUT DISCHARGE REGULATIONS.
The Catfish Farmer, Vol. 6, No. 1, p. 7-8, January, 1974.

Descriptors: *Catfishes, *Runoff, *Permits, Regulation, Waste disposal.

Most catfish farming is exempted under new EPA regulations. Those facilities not subject to NPDES requirements are: (1) closed ponds with discharges only during annual harvesting or during periods of excess runoff, (2) facilities where discharges occur less than 30 days a year, and (3) facilities where flow is continuous but total number of pounds produced per year is less than 20,000 pounds. (Cameron-East Central)
W77-01541

ENVIRONMENTAL POISONS.
For primary bibliographic entry see Field 5C.
W77-01547

HOW NOW BROWN COW: REGULATION OF FEEDLOT POLLUTION IN WISCONSIN,
C. E. Blackwell, III.
Environmental Affairs, Vol. 3, No. 4, p. 769-789, 1974.

Descriptors: *Feed lots, *Pollution abatement, *Wisconsin, *Legal aspects, *Water pollution.
Identifiers: *1972 Federal Water Pollution Control Amendments, *National Pollutant Discharge Elimination System.

Water pollution due to feedlot runoff has become a serious problem. Several legal steps are reviewed in this article which are (or have been) directed toward pollution abatement. Of major importance among such legal steps is the 1972 Federal Water Pollution Control Amendments. Section 402 of the 1972 Act establishes the National Pollutant Discharge Elimination System which has been utilized to reduce point source water pollution by feedlots. The Environmental Protection Agency (EPA), which was granted authority to administer the permit program established by this Act, has attempted to abrogate the effectiveness of the Act. This may be due to any or all of the following: (a) To include greater numbers of small feedlots would place an unacceptable economic and manpower burden on the EPA, (b) EPA pollution control efforts have been focused on urban sources of water pollution, and (c) The EPA is sensitive to criticisms from Agribusiness. While the major concern has been that strict pollution controls would cause economic dislocation, some sources such as David Blitzer (National Resources Defense Council), maintain that such controls would foster reorganization of the industry into larger and more efficient production units. The threat to water quality by agricultural runoff pollution cannot be dealt with in the manner employed to date. The problem can only be solved through the cooperation of federal, state, and local governments which, unfettered by self-interested pressure groups or concerns over administrative burdens, have the resolve and energy to obtain a high standard of water quality. (Merryman-East Central)
W77-01549

MANAGEMENT AND CONTROL OF BEEF FEEDLOT WASTE,
O. E. Cross, and C. B. Gilbertson.
Farm, Ranch, and Home Quarterly, Nebraska Agricultural Experiment Station, Lincoln, p. 20-21, Winter, 1969. 2 fig.

Descriptors: *Feed lots, *Cattle, *Nebraska, *Regulation, *Agricultural runoff, *Water pollution, *Farm wastes.
Identifiers: Detention ponds, Rainfall.

Feedlot owners are being given the legal responsibility for insuring that their operation does not contaminate Nebraska's water. The Water Pollution Control Council of the Nebraska State Department of Health has been charged with setting up regulations to maintain Nebraska's water quality. Since information on the most effective ways to dispose of feedlot waste was not available, the Nebraska Livestock Feeders Association and its Pollution Control Committee were given two years to research and develop information on which regulations could be based. Several projects are underway to determine the efficiency of several different systems of waste management. Four systems are discussed which examine several aspects of feedlot waste management. These systems cover runoff collection and treatment, movement of solids on dirt lots, and various methods of loader cleaning. Rainfall, its duration and intensity is recorded for use in the analysis. (Penrod-East Central)
W77-01550

6. WATER RESOURCES PLANNING

6A. Techniques Of Planning

A COARSE SORT SYSTEM FOR PRELIMINARY WATER RESOURCES MANAGEMENT ALTERNATIVES,
Oklahoma Univ., Norman. Bureau of Water and Environmental Resources Research.
G. W. Reid, and N. Safarik.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-260 491, Price codes: A09 in paper copy, A01 in microfiche. Completion Report, July 1976. 171 p, 2 fig, 18 tab, 66 ref, 4 append. OWRT A-054-OKLA(1). 14-34-0001-6037.

Descriptors: Water resources, *Planning, *Economics, Standards, *Alternative planning, Management, Lakes, *Oklahoma, Model studies, Methodology, *Evaluation.
Identifiers: *Arcadia Lake(Okla), *Coarse Sort System.

The present requirements for water resources planning include the development of at least two alternative plans, one emphasizing natural economic development, the other, environmental quality. The inclusion of the non-quantitative environmental objective necessitates the development of models which can deal with both quantitative and qualitative data and which provide a process for eliminating infeasible alternatives and effecting compromises between the two objectives. The Coarse Sort System is a non-mathematical model which provides a method for easily evaluating both quantitative and nonquantitative data and selecting a viable plan from among alternatives at the preliminary planning level. The Coarse Sort System requires that after alternative plans are developed, they be ranked according to how close they come to meeting the goals of the project. After they are ranked, they are displayed on sort charts, and the process of elimination (coarse sorting), trade-off and compromise follows. The sort charts provide a simple, visual method for communicating information about the various alternatives to the planners and to the public. The Arcadia Lake project in Central Oklahoma is used to illustrate the process.
W77-01055

HISTORY AND DEVELOPMENT OF MULTIPLE OBJECTIVE PLANNING FOR WATER RESOURCES,
Water Resources Council, Washington, D.C.
For primary bibliographic entry see Field 6B.
W77-01152

A SOLUTION PROCEDURE FOR THE DESIGN PROBLEM OF A MULTIPLE TREATMENT PLANT SYSTEM ALONG A STREAM,
McGill Univ., Montreal (Quebec). Dept. of Civil Engineering and Applied Mechanics.
For primary bibliographic entry see Field 5D.
W77-01165

ESTIMATION OF RESPONSE SURFACE GRADIENTS IN MULTIOBJECTIVE WATER RESOURCES PLANNING,
Waterloo Univ. (Ontario).
E. A. McBean, and J. C. Schaake, Jr.
Water Resources Research, Vol. 12, No. 4, p 592-598, August 1976. 8 fig, 15 ref.

Descriptors: *Water resources, *Planning, *Estimating, *Markov processes, *Probability, *Simulation analysis, Methodology, Riverbasins, Reservoirs, Decision making, Comprehensive planning, Alternative planning, Computer models, Hydrology, Irrigation, Mathematical models, Equations, Systems analysis.
Identifiers: *Multiple objective planning, *Screening model, Gradient estimator, Operating rule.

A probabilistic Markov model of reservoir state transitions is developed which, in combination with a simulation model, offers a computational tool for estimating response surface gradients of water resources planning problems. Use of the gradient estimation capability provides a substantial improvement in efficiency of the search for improved water resources configurations. The estimation capability arises by recognizing and

using the reservoir state transition changes that would result from a modification of decision variables. The procedure is highly flexible in that it functions under such complicated situations as multiple-objective environments, nonlinear benefit loss functions, and complex connectivity of river basin components. (Bell-Cornell)
W77-01167

AQUIFER MANAGEMENT UNDER TRANSIENT AND STEADY-STATE CONDITIONS,
Stanford Univ., Calif. Dept. of Applied Earth Sciences.
For primary bibliographic entry see Field 4B.
W77-01169

A PREDATOR-PREY MODEL FOR DISCRETE-TIME COMMERCIAL FISHERIES,
Consiglio Nazionale delle Ricerche, Milan (Italy). Centro di Teoria dei Sistemi.
M. Gatto, S. Rinaldi, and C. Walters.
Applied Mathematical Modelling, Vol. 1, No. 2, p 67-76, September 1976. 12 fig, 12 ref, 2 append.

Descriptors: *Fisheries, *Mathematical models, *Simulation analysis, Management, *Predation, Fish, Boats, Behavior, Estimating, Equations, Systems analysis, *Commercial fishing.
Identifiers: Sensitivity, Productive equilibrium, Parameter estimation.

A very simple discrete-time predator (boats) - prey (fish) model for the description of the dynamic behavior of a fishery is presented. The stability properties of the system are analyzed in some detail and the sensitivity of the equilibrium with respect to the catchability coefficient, the length of the fishing season, and the investment coefficient of the fleet is analyzed. Finally, a simple procedure is presented and utilized for estimating the characteristic parameters of the fleet of a few fisheries. The agreement between the data and the predicted results is quite satisfactory when considering the crudeness of the model. (Bell-Cornell)
W77-01171

ECOSYSTEM MODELS AND ENVIRONMENTAL POLICY,
San Diego State Univ., Calif. Center for Regional Environmental Studies.
For primary bibliographic entry see Field 6G.
W77-01172

DEVELOPING OPTIMAL OPERATING RULES FOR FLOOD PROTECTION RESERVOIRS,
Karlsruhe Univ. (West Germany). Institut fuer Wasserbau III.
For primary bibliographic entry see Field 4A.
W77-01174

THE MODELLING AND CONTROL OF POLLUTION IN A RIVER SYSTEM,
Cambridge Univ. (England). Dept. of Engineering.
For primary bibliographic entry see Field 5B.
W77-01175

WATER QUALITY CONTROL UNDER UNCERTAINTY: OPTIMAL STOPPING RULES FOR SAMPLING,
Arizona Univ., Tucson. Dept. of Systems and Industrial Engineering.
For primary bibliographic entry see Field 5G.
W77-01176

PUMPING POLICIES IN WATER SUPPLY,
Water Research Association, Marlow (England).
For primary bibliographic entry see Field 4A.
W77-01177

THE SAINT JOHN RIVER SYSTEM MODELS: A CASE STUDY,
Department of the Environment, Ottawa (Ontario). Ecological Systems Research Div.
For primary bibliographic entry see Field 5G.
W77-01178

A COMPUTER-BASED TELECONTROL AND COMMUNICATION SYSTEM FOR A WATER SUPPLY NETWORK,
East Worcestershire Waterworks Co., Bromsgrove (England).
For primary bibliographic entry see Field 4A.
W77-01179

LINEAR MODELS FOR GROUNDWATER MANAGEMENT,
Water Planning for Israel Ltd., Tel-Aviv.
For primary bibliographic entry see Field 4B.
W77-01180

MULTIOBJECTIVE PLANNING: CONCEPTS AND METHODS,
Utah State Univ., Logan. Dept. of Civil and Environmental Engineering.
For primary bibliographic entry see Field 6B.
W77-01346

ENVIRONMENTAL DATA MANAGEMENT,
For primary bibliographic entry see Field 6G.
W77-01347

NONQUANTITATIVE METHODS IN WATER RESOURCES MANAGEMENT,
Louisville Univ., Ky. Systems Science Centre.
For primary bibliographic entry see Field 6B.
W77-01348

IDENTIFYING URBAN FLASH FLOODING PROBLEMS,
Washington Univ., St. Louis, Mo. Dept. of Technology and Human Affairs.
For primary bibliographic entry see Field 4A.
W77-01351

SYSTEM ANALYSIS: SPRINKLER SPACING, (SISTEEMANALISE: SPRINKELAAR-SPASIERING),
South Africa Dept. of Agricultural Technical Services, Pretoria.
For primary bibliographic entry see Field 3F.
W77-01453

'APPROACHES TO MULTI-OBJECTIVE PLANNING IN WATER RESOURCE PROJECTS,' BY BERNARD W. TAYLOR III, K. ROSCOE DAVIS, AND RONALD M. NORTH,
Cornell Univ., Ithaca, N. Y. Dept. of Environmental Engineering.
For primary bibliographic entry see Field 6B.
W77-01510

6B. Evaluation Process

RESEARCH TO DEVELOP ECOLOGICAL STANDARDS FOR WATER RESOURCES,
Oklahoma Univ., Norman. Bureau of Water and Environmental Resources Research.
For primary bibliographic entry see Field 6G.
W77-01054

A COARSE SORT SYSTEM FOR PRELIMINARY WATER RESOURCES MANAGEMENT ALTERNATIVES,
Oklahoma Univ., Norman. Bureau of Water and Environmental Resources Research.
For primary bibliographic entry see Field 6A.
W77-01055

FUTURE DIRECTION OF URBAN WATER MODELS,
Water Resources Engineers, Inc. Walnut Creek, Calif.
For primary bibliographic entry see Field 5G.
W77-01071

CAUGHT IN MID-STREAM: ARMY CORPS OF ENGINEERS,
For primary bibliographic entry see Field 6E.
W77-01086

HISTORY AND DEVELOPMENT OF MULTIPLE OBJECTIVE PLANNING FOR WATER RESOURCES,
Water Resources Council, Washington, D.C.
G. D. Cobb.
In: Multiple Objective Planning for Water Resources, Volume 1, Proceedings of the UCOWR Workshop in Multiple Objective Planning and Decision-Making, Natural Resources Series Number 5, Idaho Research Foundation, Inc., Moscow, 1974. p 1-5.

Descriptors: *Water resources development, *Planning, *History, *Comprehensive planning, *River basin development, Regional development, Water quality, Decision making, *Water policy, Management, United States, *Legislation, *US Water Resources Council.
Identifiers: *Multiple-objective, Water quantity.

This article considers the role played by the Water Resources Council (WRC) and its Principles and Standards in the multi-objective planning and development of water resources. Two principal levels of planning are identified: National and regional or river basin, and characteristics of these levels are discussed. The history of water resources policy implementation from 1809 up to the National Environmental Policy Act of 1969 is traced. Finally, the WRC Principles and Standards are considered in detail, including their implementation and their influence upon the emergence of other natural resources policy considerations. (See also W76-11123) (Bell-Cornell)
W77-01152

THE ATTITUDE AND INTEREST OF THE ENVIRONMENTAL PROTECTION AGENCY IN MULTIPLE OBJECTIVE PLANNING OF WATER AND RELATED LAND RESOURCES,
Environmental Protection Agency, Washington, D.C. Office of Water Planning and Standards.
For primary bibliographic entry see Field 5G.
W77-01153

EMERGING CORPS OF ENGINEERS GUIDELINES FOR IMPLEMENTING THE PLANNING REQUIREMENTS OF WRC'S PRINCIPLES AND STANDARDS AND RELATED POLICIES,
Corps of Engineers, Washington, D.C. Planning Div.
W. J. Donovan, and J. J. Jordan.
In: Multiple Objective Planning for Water Resources, Volume 1, Proceedings of the UCOWR Workshop in Multiple Objective Planning and Decision-Making, Natural Resources Series Number 5, Idaho Research Foundation, Inc., Moscow, p 9-19, 1974. 1 fig, 2 tab, 3 ref.

Descriptors: *Water resources development, *Planning, *Water policy, Methodology, Alternative planning, Environment, Quality control, Regional development, Evaluation, U.S. Water Resources Council.
Identifiers: *Multiple objective planning, Impact assessment, Social well-being.

The consideration herein is how to implement the multi-objective planning requirements of the Water Resources Council's Principles and Standards (P&S). The paper outlines the essential pol-

icy framework in which the U.S. Army Corps of Engineers proposes to implement P&S, highlights the limitations of P&S as a planning document, provides a limited, nondetailed exposition of a multi-objective planning process through plan selection and recommendation, and, finally, suggests some areas in which further research appears to be needed. The emphasis is methodological. Four functional planning tasks to be carried out during each of three stages of the planning process are identified and described: problem identification; formulation of alternatives; impact assessment; and evaluation. The impact categories, or objectives considered are national economic development, environmental quality, social well-being, and regional development. It is concluded that while there remain differences of view in high places regarding the appropriate number and content of the national objectives, acceptance of the concept of multi-objective planning as official national policy represents a substantial advance over the earlier, singular approach of economic development, the traditional objective of benefit-cost analysis. (See also W76-11123) (Bell-Cornell)
W77-01154

IMPLEMENTATION OF MULTIPLE OBJECTIVE PLANNING BY THE SOIL CONSERVATION SERVICE,
Soil Conservation Service, Washington, D.C. River Basin.
E. C. Buie.
In: Multiple Objective Planning for Water Resources, Volume 1, Proceedings of the UCOWR Workshop in Multiple Objective Planning and Decision-Making, Natural Resources Series Number 5, Idaho Research Foundation, Inc., Moscow, p 20-23, 1974.

Descriptors: *Planning, *Environment, *Water resources development, Water management(Applied), Regional development, Economics, Conservation, Alternative planning, U.S. Water Resources Council.
Identifiers: *Multiple objective planning, *Principles and Standards(Water Resources Council), Public participation, Environmental quality, National economic development.

The Soil Conservation Service (SCS) fully supports the concept of multiple objective planning. Since its inception in the mid-1930's, the SCS has followed this concept in all its programs. Within the last 20 years, as the programs of the SCS have become more water-management oriented, these same multiple objective concepts have guided the planning process. The SCS participated actively in the development and testing of the Water Resources Council's Principles and Standards. Discussed are limitations of the approved Principles and Standards and problems in implementation. Considered next are: The Optimum National Economic Development Plan (ONED); the Environmental Quality Plan; alternative plans; public participation; regional development; and additional needs wherein a wide range of environmental goals is needed. In conclusion the SCS fully supports the concept of multiple objective planning and has done this consistently throughout its agency life. Although it is encountering problems, several of these problems offer opportunities for research; answers or more rational procedures are essential to the effective and complete implementation of this process. (See also W76-11123) (Bell-Cornell)
W77-01155

PHILOSOPHY OF MULTIPLE OBJECTIVE PLANNING IN THE BUREAU OF RECLAMATION,
Bureau of Reclamation, Washington, D.C.
D. L. Porter.
In: Multiple Objective Planning for Water Resources, Vol. 1, Proceedings of the UCOWR Workshop in Multiple Objective Planning and Decision-Making, Natural Resources Series Number 5, Idaho Research Foundation, Inc., Moscow, p 23-28, 1974.

Descriptors: *Water resources development, *Planning, *Research, History, Social aspects, Evaluation, Environment, Regional development, Cost allocation, U.S. Water Resources Council.
Identifiers: *Multiobjective planning, *Principles and Standards(Water Resources Council).

This article discusses problem areas of the Water Resources Council's Principles and Standards for multi-objective planning where research would be beneficial. The paper begins with a history review and then considers plan formulation, formulation to emphasize national economic development evaluation, environmental quality evaluation, regional development evaluation, evaluation of social factors, cost allocations, and the coordination and review of planning studies. It is concluded that new or improved procedures are needed in every area that demands the characteristics of multi-objectives, externalities, social values, etc. All effects, tangible and intangible, primary and secondary, on the multi-objectives need to be evaluated and considered in planning for water resources development. (See also W76-11123) (Bell-Cornell)
W77-01156

THE TENNESSEE VALLEY AUTHORITY AND MULTIPLE OBJECTIVE PLANNING,
Tennessee Valley Authority, Norris. Div. of Water Control Planning.
W. G. O'Neal.
In: Multiple Objective Planning for Water Resources, Vol. 1, Proceedings of the UCOWR Workshop in Multiple Objective Planning and Decision-Making, Natural Resources Series Number 5, Idaho Research Foundation, Inc., Moscow, p 31-34, 1974.

Descriptors: *Water resources development, *Planning, *Tennessee Valley Authority, History, Economics, Decision making, Water policy, Standards, Flood control, Costs, Benefits, Environment, U.S. Water Resources Council.
Identifiers: *Multiple objective planning.

Policies and procedures for water planning have long been the subject of controversy in this country. Economists continually disagree among themselves, and many competing interests constantly question each other's motives and actions. This disagreement over the numerous theoretical and methodological issues involved is symptomtic of the fact that the subject of controversy probably involves matters of real consequences. Moreover, some key issues need resolving which involve political and policy decisions, and the controversy is unlikely to have a simple and quick solution. This article questions whether application of the Water Resources Council's Principles and Standards for multiple objective planning can be expected to improve the public decision-making process in water resource planning. Discussed are selected items from the Tennessee Valley Authority's planning background which may be useful in understanding today's situation. Described are the TVA's experience in testing the new multiple objective planning approach and plans for applying it. (See also W76-11123) (Bell-Cornell)
W77-01157

THE DEPARTMENT OF TRANSPORTATION - USE OF MULTI-OBJECTIVE PLANNING,
Department of Transportation, Washington, D.C.
W. Riedal.
In: Multiple Objective Planning for Water Resources, Vol. 1, Proceedings of the UCOWR Workshop in Multiple Objective Planning and Decision-Making, Natural Resources Series Number 5, Idaho Research Foundation, Inc., Moscow, p 34-35, 1974.

Descriptors: *Water resources, *Planning, *Transportation, *Water policy, Legislation, U.S. Water Resources Council.
Identifiers: *Mulitople objective planning.

The Department of Transportation consists of seven operating administrations, including the St. Lawrence Seaway Development Corporation, the Federal Highway Administration, and the United States Coast Guard. Despite its comprehensive nature, the Department of Transportation does not have a major role in water resources multi-objective planning, since it is precluded from setting criteria or standards for the formulation and economic evaluation of all proposals where federal funds are invested in transportation facilities or equipment. However, in recent years, certain congressional acts have necessitated the Department's (DOT) increased involvement in water resources multi-objective planning (MOT). New doors have been opened concerning navigation projects. But DOT's role is still reactive. Criticized is the role provided for the DOT by the Water Resources Council's Principles and Standards. In order for the DOT to effectively implement MOP, changes are required. (See also W76-11123) (Bell-Cornell)
W77-01158

IMPLEMENTATION OF MULTI-OBJECTIVE PLANNING IN THE DEPARTMENT OF COMMERCE,
Department of Commerce, Washington, D.C. Office of Policy Development and Coordination.
D. R. Baker.
In: Multiple Objective Planning for Water Resources, Vol. 1, Proceedings of the UCOWR Workshop in Multiple Objective Planning and Decision-Making, Natural Resources Series, Number 5, Idaho Research Foundation, Inc., Moscow, p 35-38, 1974.

Descriptors: *Water resources, *Planning, *Administrative agencies, Economics, Environment, Transportation, U.S. Water Resources Council.
Identifiers: *Multiple objective planning.

The Department of Commerce initiates very few water resources planning studies; Commerce's usual role as a participant in planning will continue with the Water Resources Council's new goal of multiple objective planning. There is considerable interest in the Department of Commerce in maximizing national economic development and environmental quality control. The Department participates with other agencies as well in water resources planning. Since these efforts are not widely known, and since the Department has a relatively wide range of information and expertise useful to planning studies, this article presents an explanation of Commerce's role in planning to serve as a guide to those interested in implementing the new multi-objective planning. Given is a partial summary of the missions for six of the Department's administrative units that effect or are affected by water resources planning. Considered are the Departments operating units: (1) Domestic and International Business/Bureau of Domestic Commerce; (2) Maritime Administration; (3) Economic Development Administration; (4) Regional Action Planning Commissions; (5) Social and Economic Statistical Administration/Bureau of Economic Analysis; and (6) National Oceanic and Atmospheric Administration. (See also W76-11123) (Bell-Cornell)
W77-01159

CONCERNS OF THE U.S. FISH AND WILDLIFE SERVICE IN MULTI-OBJECTIVE PLANNING,
Bureau of Sport Fisheries and Wildlife, Washington, D.C.
G. L. Hickman.
In: Multiple Objective Planning for Water Resources, Vol. 1, Proceedings of the UCOWR Workshop in Multiple Objective Planning and Decision-Making, Natural Resources Series, Number 5, Idaho Research Foundation, Inc., Moscow, p 41-44, 1974.

Descriptors: *Fish, *Wildlife, *Planning, *Water resources, Land resources, Ecology, Environment, Research priorities, U.S. Water Resources Council.
Identifiers: *Multiobjective planning, *Fish and Wildlife Service, Principles and Standards(Water Resources Council), Environmental quality, Public participation, National economic development.

The U. S. Fish and Wildlife Servicebelieves that true multi-objective plan formulation occurs as a fourth major phase in the planning process under the Principles and Standards. To place the National Economic Development (NED) and Environmental Quality (EQ) alternative futures in perspective in a given planning area, to aid in scoping each alternative, and to avoid extraneous materials from creeping into the planning process (i.e., such as those associated with Regional Development or Social Well-being), it is believed that the study area component need should be immediately identified as to whether they are National Economic or Environmental Quality in nature. As a second step, a separate plan should be formulated for the EQ objective, and one for the NED objective. Complementary features of the opposing objective should be used in formulating both plans. Only after such plans have been formulated and the effects of each plan evaluated against the four accounts listed in the standards should multi-objective plan formulation be started. Discussed herein are responsibilities of the Fish and Wildlife Service, aspects of environmental quality planning, public participation and input, the environmental quality objective, the ecological resource component, and research needs. (See also W76-11123) (Bell-Cornell)
W77-01160

THE USE OF MULTIPLE OBJECTIVE PLANNING IN THE BUREAU OF LAND MANAGEMENT,
Bureau of Land Management, Denver, Colo.
G. Fulcher.
In: Multiple Objective Planning for Water Resources, Vol. 1, Proceedings of the UCOWR Workshop in Multiple Objective Planning and Decision-Making, Natural Resources Series, Number 5, Idaho Research Foundation, Inc., Moscow, p 44-49, 1974.

Descriptors: *Land management, *Planning, Standards, Water resources, *Land use, Decision making, Economics, Evaluation, History, U.S. Water Resources Council.
Identifiers: *Multiple objective planning, Public participation.

The Bureau of Land Management views multiple objective planning in a different perspective than many other Federal agencies and institutions. It considers multiple use planning with its variety of objectives as synonomous with multiple objective planning; the Water Resources Council (WRC) Principles and Standards are merely evaluation procedures that can be applied to evaluating the effectiveness of its multiple use planning system. Only recently has the Bureau become seriously involved in trying to apply the WRC standards to evaluating its land management practices. It now plans to test the standards for evaluating its land management programs, and a team has been assigned to test the procedures on specified activities in Oregon and New Mexico. It is anticipated that procedures will be developed from these tests for Bureau-wide implementation of the WRC standards in its planning system. This paper considers the Bureau's involvement in multiple use (multiple objective) planning to date; the paper attempts to outline the history of planning in the Bureau, current status and components of the planning system, and some deficiencies that have been noted. (See also W76-11123) (Bell-Cornell)
W77-01161

PERSPECTIVE AND ROLE OF THE ECONOMIC RESEARCH SERVICE IN MULTIPLE OBJECTIVE PLANNING,
Department of Agriculture, Lincoln, Nebr.
N. E. Landgren.
In: Multiple Objective Planning for Water Resources, Vol. 1, Proceedings of the UCOWR Workshop in Multiple Objective Planning and Decision-Making, Natural Resources Series, Number 5, Idaho Research Foundation, Inc., Moscow, p 49-52, 1974.

Descriptors: *Economics, *Research, *Agriculture, *Natural resources, *Planning, Management, Conservation, Water resources, U.s. Water Resources Council.
Identifiers: *Multiple objective planning, *Economic Research Service (U.S. Dept. of Agriculture), Principles and Standards(Water Resources Council).

This presentation brings into focus some of the potential contributions of the Economic Research Service (ERS), U.S. Department of Agriculture, in multi-objective planning for the utilization, management, conservation and development of natural resources. This is accomplished by first describing the nature of Economic Research Service (ERS) participation in natural resources planning. This is followed by a brief discussion of the perspective of ERS as it relates to planning activities. Thirdly, some problem areas in which the Economic Research Service has both an interest and analytical capability are identified. (See also W76-11123) (Bell-Cornell)
W77-01162

ESTIMATION OF RESPONSE SURFACE GRADIENTS IN MULTIOBJECTIVE WATER RESOURCES PLANNING,
Waterloo Univ. (Ontario).
For primary bibliographic entry see Field 6A.
W77-01167

EVALUATING ENVIRONMENTAL QUALITY MANAGEMENT PROGRAMMES IN WHICH DISCHARGERS ARE GROUPED,
Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5G.
W77-01170

LEGAL PROBLEMS ASSOCIATED WITH THE ROLE OF PLANNING IN WATER RESOURCES MANAGEMENT,
Melbourne Univ., Parkville (Australia). College of Law.
For primary bibliographic entry see Field 6E.
W77-01185

FLORIDA'S SYSTEM FOR REGULATION OF WATER USE--A MODERN INSTRUMENT FOR SOUND WATER RESOURCE MANAGEMENT,
Florida Univ., Gainesville. Coll. of Law.
For primary bibliographic entry see Field 6E.
W77-01186

THE COST-EFFECTIVENESS APPROACH IN ANALYZING A WATER SUPPLY PROJECT FOR THE SANTA ELENA PENINSULA, ECUADOR,
Arizona Univ., Tucson. Dept.of Hydrology and Water Resources.
J. C. Villao-Yepez.
Master of Science Thesis, 1975. 90 p, 12 fig., 14 tab, 26 ref, 2 append.

Descriptors: *Cost analysis, *Economic efficiency, *Water resources development, Project feasibility, Social aspects, Dynamic programming, Water quality standards, Water shortage.
Identifiers: *Cost-effectiveness analysis, *Santa Elena Peninsula(Ecuador).

A cost-effectiveness approach is presented for analysis of a water resource project in the Santa Elena peninsula of Ecuador, an area where lack of an appropriate water supply scheme has been detrimental to population health and living standard. The area and its specific water problems are discussed along with the methodology employed. The planning process begins by identification of goals which satisfy the social, economic and physical needs of the area. A relevance-tree technique was used to classify goals and relate them to system specifications. Points covered include the selection of fixed-effectiveness, merits of alternative systems analyzed in a tabular array, sensitivity analysis of each system in achieving measures of effectiveness and choice of the most appropriate alternative. Water quality analysis is done for each system, including bacteriological and physical-chemical water quality standards. The methodology is applied using the traditional approach and recent improvements in water resource planning for developing countries. (Jahns-Arizona)
W77-01270

GUIDELINES FOR LAKE WATERSHED MANAGEMENT PLANNING.
Maine Dept. of Environmental Protection, Augusta. Bureau of Water Quality Control.
For primary bibliographic entry see Field 5G.
W77-01291

COFFEE POND WATERSHED MANAGEMENT PLAN.
Maine Dept. of Environmental Protection, Augusta. Bureau of Water Quality Control.
For primary bibliographic entry see Field 5G.
W77-01292

FOREST LAKE WATERSHED MANAGEMENT PLAN.
Maine Dept. of Environmental Protection, Augusta. Bureau of Water Quality.
For primary bibliographic entry see Field 5G.
W77-01293

RESOURCE INVENTORY MANAGEMENT PLANNING SYSTEM (RIMPS). USER MANUAL,
Jordan (Edward C.), Inc., Portland, Maine.
For primary bibliographic entry see Field 5G.
W77-01294

FEDERAL MANPOWER IN WATER RESOURCE ENGINEERING,
Bureau of Reclamation, Denver Colo.
E. R. Lewandowski.
Journal of the Water Resources Planning and Management Division, Vol. 102, No. WR2, p 185-192, November 1976. 1 fig, 11 ref.

Descriptors: *Water resources development, *Engineering education, *Social impact, History, Federal government, Manpower, Personnel, *Engineering personnel.
Identifiers: *Developing countries, *Manpower utilization, Population(Statistics).

There are over 20,000 water resource engineers employed by all branches of the Federal government. Forecasts indicate more will be needed in the years ahead. Their tasks are constantly changing and they are being required to adapt to amplified responsibilities in connection with the search for new and varied sources of energy in which water plays a critical role. In addition, our engineers are being asked to adopt the role of educator in training and inspiring the engineers of developing nations in order that these countries may become self-sufficient in food and power production. The ways in which formal engineering education itself should modify the traditional approach and broaden the social and political consciousness of the developing engineer and aid the

practicing professional are covered. The future requirements for Federal manpower are explored. The varied disciplines necessary to solve new problems in desalting, wastewater treatment, and weather modification are summarized. (Bell-Cornell)
W77-01342

EDUCATION AND TRANING IN WATER RESOURCES PLANNING,
Polytechnic Inst. of New York, Brooklyn.
A. S. Goodman.
Journal of the Water Resources Planning and Management Division, Vol. 102, No. WR2, p 209-218, November, 1976. (Proceedings of the American Society of Civil Engineers) 1 fig, 9 ref.

Descriptors: *Water resources, *Water resources development, *Education, *Engineering education, Planning, civil engineering, *Training, Planning.
Identifiers: *Graduate study, *Water plans, Civil engineers, Continuing education.

Water resources planning may be defined to include the identification and evaluation of water resources, and the planning of projects that utilize and control water. In addition to having a background in engineering subjects and physical and biological sciences related to water, the practitioner in this field should ideally be skilled or knowledgeable, or both, in economics and other social sciences, legal matters, and other aspects of planning. Basic skills that should be developed in an undergraduate program are reviewed. Informal and formal education and training following the first degree, and one graduate course in water resources are described in some detail. (Bell-Cornell)
W77-01344

MULTIOBJECTIVE PLANNING: CONCEPTS AND METHODS,
Utah State Univ., Logan. Dept. of Civil and Environmental Engineering.
A. B. Bishop, M. McKee, T. W. Morgan, and R. Narayanan.
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol. 102, No. WR2, p 239-253, November 1976. 4 fig, 3 tab, 43 ref.

Descriptors: *Water resources development, *Decision making, *Social values, *Planning, Methodology, Model studies, Systems analysis, *Multiple-purpose projects.
Identifiers: *Multiple objective planning, Social welfare, Public opinion.

Present day water resources planning encompasses social, environmental, and economic objectives in developing and choosing among alternative plans. Recent efforts to operationalize multiobjective planning have engendered a variety of new techniques. Where the emphasis has been on methodological developments, this paper considers how developing methodologies relate to the water resources planning process. In terms of the basic problem of multiobjective analysis, the function of the planning process is seen as integrating technical information from the planning team and social value information from the publics to arrive at a socially preferred alternative. A model of this process is presented and some desired attributes of multiobjective methods to support the process are identified. Several classes of multiobjective methods are described and compared as to their implementation requirements and their characteristics relative to both technical and value aspects of the planning process. Discussed are: visual techniques; rating and ranking methods; matrix and linear scoring methods; tradeoff displays and analysis; multiobjective programming; goals evaluation techniques; and iterative methods. (Bell-Cornell)
W77-01346

NONQUANTITATIVE METHODS IN WATER RESOURCES MANAGEMENT,
Louisville Univ., Ky. Systems Science Centre.
R. K. Ragade, K. W. Hipel, and T. E. Unny.
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol. 102, No. WR2, p 297-309, 4 fig, 4 tab, 11 ref.

Descriptors: *Water resources, *Management, *Aesthetics, Optimization, *Planning, Methodology, Decision making, Evaluation, Social needs, Equations, Systems analysis, Algorithms, Water demand, Recreation.
Identifiers: Quantitative analysis, *Nonquantitative methods, Aesthetic properties, International pollution conflict.

In water resources planning, problems often arise where consideration must be given to intangible variables. If 'quantitative' optimization techniques are used, assigning numeric values to the intagibles usually fails to account for them satisfactorily. Furthermore, quantifying such factors can be classed under 'unnatural' methods of analysis. This is particularly true in humanistic and societal decision making, where one has to make many kinds of ethical and value judgments. Quantitative optimization methods though precise, become difficult to justify unless supplemented by subjective and other criteria. This paper examines the aforesaid problems and surveys alternative methods of analysis based upon 'nonquantitative' (i.e., 'non-numeric' and 'quasi-numeric') considerations of the variables. These method include fuzzy set theory, metagame analysis, and pseudoboolean methods. In conclusion, recent developments in non-numeric methods show promise for handling system design problems where intangibles need to be systematically accounted for and evaluated. (Bell-Cornell)
W77-01348

WATER CONFLICTS IN WESTERN COAL DEVELOPMENT,
Montana State Univ., Bozeman. Dept. of Civil Engineering and Engineering Mechanics.
For primary bibliographic entry see Field 3E.
W77-01349

'APPROACHES TO MULTI-OBJECTIVE PLANNING IN WATER RESOURCE PROJECTS,' BY BERNARD W. TAYLOR III, K. ROSCOE DAVIS, AND RONALD M. NORTH,
Cornell Univ., Ithaca, N. Y. Dept. of Environmental Engineering.
L. M. Falkson.
Water Resources Bulletin, Vol. 12, No. 5, p 1071-1077, October 1976. 1 fig, 15 ref.

Descriptors: *Water resources, *Project planning, *Economics, *Systems analysis, Linear programming, Optimization, Simulation analysis, Algorithms, Benefits, Costs, Measurement, Reservoirs, Storage, Mathematical models.
Identifiers: *Multi-objective planning, Penalty costs, Goal programming, Minimization, Benefit maximization, Water uses.

One of the approaches to multiple objective planning in water resource projects discussed by the authors in this paper is goal programming. The purpose of this note is to comment upon the similarity and differences between the goal programming framework and the short-run loss function-target output concepts which appear in much of the water resource literature on the application of mathematical programming and simulation to water resources project design and operation (Maass, et al., 1962; Hufschmidt, 1963; Hufschmidt and Fiering, 1966; and Loucks, 1969). Mathematically, the incorporation of piecewise linear loss functions into a water resource system model is equivalent to goal programming. However, the economic interpretation of the two approaches is quite different. From the standpoint of theoretical welfare economics, there are only two basic objectives, economic efficiency, and equity in the distribution of income. (See also W76-01335) (Bell-Cornell)
W77-01510

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

AN EXPLORATORY STUDY OF POSSIBLE ENERGY SAVINGS AS A RESULT OF WATER CONSERVATION PRACTICES,
Oklahoma Univ., Norman. Bureau of Water and Environmental Resources Research.
For primary bibliographic entry see Field 3E.
W77-01052

THE IMPACT OF INCREASED ENERGY COSTS ON WATER USE AND AGRICULTURAL OUTPUT IN NORTHWESTERN OKLAHOMA,
Oklahoma State Univ., Stillwater. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 3F.
W77-01056

A FEASIBILITY/DEVELOPMENT STUDY FOR THE REMOVAL OF AMMONIA FROM WASTEWATER USING BIOLOGICALLY REGENERATED CLINOPTILOTITE,
Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5D.
W77-01057

PUMPING POLICIES IN WATER SUPPLY,
Water Research Association, Marlow (England).
For primary bibliographic entry see Field 4A.
W77-01177

THE COST-EFFECTIVENESS APPROACH IN ANALYZING A WATER SUPPLY PROJECT FOR THE SANTA ELENA PENINSULA, ECUADOR,
Arizona Univ., Tucson. Dept.of Hydrology and Water Resources.
For primary bibliographic entry see Field 6B.
W77-01270

ENERGY FOR WATER,
Southern California Metropolitan Water District, Los Angeles.
For primary bibliographic entry see Field 6D.
W77-01273

ENERGY SOURCES FOR IRRIGATION PUMPS IN NORTHWESTERN NEW SOUTH WALES,
University of New England, Armidale (Australia). Dept. of Geography.
For primary bibliographic entry see Field 3F.
W77-01274

CLEARING AN ALLIGATOR JUNIPER WATERSHED WITH SAWS AND CHEMICALS: A COST ANALYSIS,
Forest Service (USDA), Fort Collins, Colo. Rocky Mountain Forest and Range Experiment Station.
For primary bibliographic entry see Field 4D.
W77-01430

6D. Water Demand

THE INTERFACE BETWEEN PLANNING AND WATER LEGISLATION,
For primary bibliographic entry see Field 6E.
W77-01183

WATER LAW AND NEW TECHNOLOGIES.
United Nations, New York.
For primary bibliographic entry see Field 6E.
W77-01184

ENERGY FOR WATER,
Southern California Metropolitan Water District, Los Angeles.
J. H. Lauten.
American Water Works Association, Journal, Vol. 68, No. 7, p. 353-356, July, 1976.

Descriptors: *Water supply, *California, *Metropolitan Water Dist. of So. Cal., *Costs, *Water delivery, Colorado River Aqueduct, Aqueducts, Environmental effects, *Energy.

The prospects for securing sufficient energy in order to provide adequate water to Southern California are discussed. The energy requirements of water delivery to the area from Northern California and from the Colorado River are evaluated. These figures and related costs are compared with costs for pumping groundwater and reclaiming wastewater. New energy sources and effects on environment are also discussed. The author concludes that the rapidly increasing cost of some of the energy needed for pumping has become a serious problem and the public will have to be prepared to face increased power costs within the next few years. (Jamail-Arizona)
W77-01273

WATER CONFLICTS IN WESTERN COAL DEVELOPMENT,
Montana State Univ., Bozeman. Dept. of Civil Engineering and Engineering Mechanics.
For primary bibliographic entry see Field 3E.
W77-01349

WATER AVAILABLE FOR ENERGY--UPPER COLORADO RIVER BASIN,
Utah State Engineer's Office, Salt Lake City.
For primary bibliographic entry see Field 3E.
W77-01350

THE EFFECTS OF PRESSURE ON DOMESTIC WATER SUPPLY INCLUDING OBSERVATIONS ON THE EFFECT OF LIMITED GARDEN-WATERING RESTRICTIONS DURING A PERIOD OF HIGH DEMAND,
Johannesburg City Engineer's Dept. (South Africa).
For primary bibliographic entry see Field 3D.
W77-01360

THOR ACROSS THE LIMPOPO.
For primary bibliographic entry see Field 8A.
W77-01369

AFFORESTATION, CATCHMENT PROTECTION AND WATER SUPPLY DEMANDS,
Australian National Univ., Canberra. Dept. of Forestry.
For primary bibliographic entry see Field 4D.
W77-01371

POWER AND WATER FOR SOUTH WEST AFRICA,
South West Africa Water and Electricity Corp. (Pty) Ltd., Windhoek.
For primary bibliographic entry see Field 3E.
W77-01382

OPTIMUM UTILISATION OF WATER,
Department of Agricultural Technical Services, Stellenbosch (South Africa). Winter Rainfall Region.
For primary bibliographic entry see Field 3F.
W77-01383

MUNICIPAL WATERSHED MANAGEMENT SURVEY,
Forest Service (USDA), Franklin, N.C. Coweeta Hydrologic Lab.
For primary bibliographic entry see Field 4D.
W77-01422

ESCOM PIONEERS DRY COOLING,
For primary bibliographic entry see Field 3E.
W77-01467

THE COOLING WATER EQUATION,
W. Van Der Merwe, and G. C. Hill-Smith.
Construction in Southern Africa, Vol 20(5), p 99-111, 1975. 4 tab.

Descriptors: *Water requirements, *Thermal powerplants, Water resources development, *Water demands, Africa, *Electric power, Demand, Water yield, *Cooling tower.
Identifiers: Umpilusi River, Hlelo River, *Dry cooling, Komati River, Pongola River, Usutu River, Slang River, Olifants River, Assegaai River, Boekenhoutrand Dam, Rosentuin Dam, *South Africa, *Transvaal.

South Africa's phenomenal economic growth over the last few years has brought with it a steeply rising demand for power. To meet this demand, South Africa's Electricity Supply Commission (ESCOM) has embarked upon a vigorous expansion programme and several new thermal power stations are being built in the Eastern Transvaal. The commissioning of these new units, however, will greatly increase ESCOM's water supply requirements. This paper, presented at the recent Cape Town conference on 'Energy and its future in Southern Africa' analyses the problem and offers some solutions. Dry cooling is explained and reasons are presented why (at present, at least) ESCOM wishes to defer large-scale adoption of dry cooling for as long as possible. Water yield from possible dam sites in all the major rivers of the Eastern Transvaal and extreme Northern Natal are investigatd. (South Africa)
W77-01468

DAMMING THE CROCODILE.
Construction in Southern Africa, Vol 19(11), p 67, 71, 73, (1975). 3 fig, 1 tab.

Descriptors: Dam design, Water supply, Costs, Water utilization, *Pre-impoundment, Industrial water, Domestic water, Irrigation water, Earthfill dams, Water requirements, Water demand.
Identifiers: *South Africa, *Crocodile River, Roodekopjes Dam.

The Department of Water Affairs is planning to build a dam on the Crocodile River near Brits. The Roodekopjes Dam, as it will be called, will help considerably in meeting water requirements for mining and industrial development, domestic usage and agriculture in the area. The dam will comprise an earth embankment with a gated concrete spillway and will cost in the region of R5,580,000. Existing dams in the area include the Kliproos, Vaalkop and Bospoort dams and the Department of Water Affairs is planning to operate these and Roodekopjes as a single unit in order to give the maximum advantage from them. (South Africa)
W77-01472

QUENCHING SALDANHA'S THIRST.
For primary bibliographic entry see Field 3E.
W77-01473

6E. Water Law and Institutions

THE MERRI CREEK FLOOD, 15-16 MAY 1974; CITIES OF NORTHCOTE BRUNSWICK (AUSTRALIA),
Melbourne and Metropolitan Board of Works (Australia). Main Drainage Div.
For primary bibliographic entry see Field 2E.
W77-01069

STATE REGULATION OF COASTAL WATER AREA PRESERVES,
Miami Univ., Fla., School of Law.
C. Hatfield.
Available from the National Technical Information Service, Springfield, VA 22161 as COM-75 11172, Price code: A04 in paper copy, A01 in microfiche. Report No. FY 75-3, December 1974, 58 p.

Descriptors: *Shore protection, *Estuaries, *Coastal marshes, *Conservation, *Preservation, Protection, Coasts, Jurisdiction, International law, Administrative agencies, Federal government, State governments, Governmental interrelations, Parks, State jurisdiction, Wetlands, Legislation, Fisheries, Research facilities, Regulation, Political aspects, International waters, *Florida, On-site investigation.
Identifiers: *Coastal zone management, *Coastal waters.

Current demographic projections estimate that 80% of the population will live within 50 miles of the United States coastline by the year 2000. Protection of the ecological systems in these areas is necessary and could be achieved through reservation of permanent preserves or sanctuaries. The author discusses legislation enacted for the protection of marine sanctuaries by Florida, Massachusetts, Hawaii and California. Estuarine sanctuaries for research purposes have been set aside in Maine, Illinois, Wisconsin, Indiana, Ohio, Minnesota, and Florida. Problems which may arise in the establishment of a state sanctuary include conflicts with international law because of the 3-mile limit; jurisdictional conflicts between state and federal government where federal and state sanctuaries are contiguous; conflicts between the state and various federal regulatory agencies; and the question of compensation for private owners within a sanctuary area. Specific recommendations are made for the establishment and management of marine and estuarian sanctuaries. (Capehart-Florida)
W77-01072

BETTER THAN BEST: A CROSSCURRENT IN THE FEDERAL WATER POLLUTION CONTROL ACT AMENDMENTS OF 1972,
Cook Coll., New Brunswick, N.J.
For primary bibliographic entry see Field 5G.
W77-01073

THE 200-MILE EXCLUSIVE ECONOMIC ZONE: DEATH KNOLL FOR THE AMERICAN TUNA INDUSTRY,
F. Froman.
San Diego Law Review, Vol 13, p 707-741 (1976). 35 p, 1 fig, 4 map.

Descriptors: *Oceans, *Jurisdiction, *Fishing, *Law of the sea, *Fish migration, International law, Conferences, Treaties, Foreign waters, Political aspects, Legal aspects, Fisheries, Fish conservation, Marine fish, Boats, Unemployment, Economic impact, Federal government, Legislation, Coasts, Foreign countries.
Identifiers: *Coastal waters, *Tuna, Fishing industry, Licenses.

The concept of a 200-mile exclusive economic zone to protect coastal fisheries was discussed at the 1974 Law of the Sea Conference. The United

States is considering unilateral declaration of such an economic zone. Although the U.S. zone would exempt highly migratory fish species, the tuna industry asserts that this exception would go unnoticed by other countries who would then extend their own jurisdictions without the migratory exclusion. The effect of such a zone on the U.S. tuna industry would be disastrous. The tuna fishing techniques are shallow-water oriented with 80% of the Pacific tuna catch inside 200 miles of the Latin American coastal waters and 100% of the Atlantic catch within 200 miles of African waters. Destruction of the tuna fishing and processing industry would have significant national economic impact and a crippling economic effect in Southern California, Puerto Rico, and American Samoa. While concluding that world-wide cooperation through an international treaty would be the most effective solution, the author suggests use of force, negotiation or purchase of fishing rights, limited international agreement, and domestic legislation as alternative solutions to the problem. (Capehart-Florida)
W77-01074

RECENT DEVELOPMENTS IN THE LAW OF THE SEA: A SYNOPSIS,
R. G. Pickering, and W. W. Taylor.
San Diego Law Review, Vol 13, p 628-666 (1976), 38 p.

Descriptors: *Law of the sea, *Conservation, *Water pollution control, *Natural resources, *International law, Legal aspects, Conferences, Pollution, Ships, Jurisdiction, Manganese, Marine fisheries, Oil spills, Offshore platforms, Canals, Migration, Protection, Water pollution, Panama Canal, Research and development, Oceans, Ownership of beds, Continental shelf.
Identifiers: *Ocean dumping, *Ocean resources, *Thermal energy, Suez Canal, Tuna, Economic zones.

The second substantive session of the Third United Nations Law of the Sea Conference was held in Geneva in 1975. The major concerns of the conference included the following: (1) the development of a system for managing the exploration and exploitation of deep seabed resources; (2) an extension of the territorial sea from 3 to 12 miles; (3) establishment of an exclusive economic zone of 200 miles; (4) the establishment of guidelines for scientific research; and (5) the protection of the marine environment. Othe recent law of the sea developments are summarized under specific headings. The conservation area deals mainly with fishing quotas. The fishing category includes jurisdictional agreements and disagreements as to economic zones. The discussion of pollution and pollution control is divided into international, federal, and state subcategories with the main emphases on oil spills and ocean dumping. The seabed resources area covers oil leasing, manganese nodule mining, and ocean thermal energy. The category of shipping includes the United Nations Draft Convention on Shipping, the United States Deepwater Port Act of 1974, and information on the Suez and Panama Canals. The final area of sovereignty includes federal sovereignty over the Atlantic Continental Shelf and over certain Alaskan submerged lands. (Capehart-Florida)
W77-01075

THE NATIONAL PERMIT PROGRAM: A POLLUTER'S BRIDGE OVER TROUBLED WATERS,
For primary bibliographic entry see Field 5G.
W77-01076

OFFSHORE BOUNDARIES: ENGINEERING AND ECONOMIC ASPECTS,
National Ocean Survey, Rockville, Md.
H. Orlin.
Ocean Development and International Law Journal, Vol 3, p 87-96 (1975). 10 p, 1 fig.

Descriptors: *International law, *Law of the sea, *Boundaries(Property), *Continental shelf, Continental slope, Submarine canyons, Sedimentation, Geomorphology, Marine geology, Oceans, Sound waves, Sounding, Data collections, Maps, Surveys.
Identifiers: *Coastal waters, *Contiguous zones.

Aside from political and economic considerations, the setting of national and economic offshore boundaries presents some very practical problems. Boundary setting invalues three aspects: delimitation, demarcation, and recovery. Delimitation is the agreement as to boundary definition. Demarcation actually establishes the location of the boundary and recovery refers to returning to or physically recognizing the boundary. Demarcation and recovery present certain technological difficulties with regard to the sea. If boundaries are established in terms of distance from baseline no major problems are involved once such baselines are established. Determination of boundaries in tems of depth, slope-rise intersection, or oceanic-continental crust intersection, however, require use of equipment for acoustical or echo measuring; and data in existence regarding ocean floors is not always accurate or complete. In addition, some demarcations are more clear than others in various areas of the world. All in all, international consideration of the problems involved beforehand can prevent years of future dispute. (Comer-Florida)
W77-01077

OWNERSHIP ON NAVIGABLE WATERBOTTOMS--CALIFORNIA COMPANY V PRICE REVISITED,
F. J. Crosby.
Louisiana Law Review, Vol 36, p 694-704 (Winter 1976), 11 p.

Descriptors: *History, *Louisiana, *Judicial decisions, *Ownership of beds, *Beds under water, Legal aspects, State governments, Beds, Boundaries(Property), Navigable rivers, Navigable waters, Streambeds, Riparian rights, High water mark, Low water mark.

Examined here is whether a state or private entity holds title to beds of navigable waterways. The question arose in Louisiana, where the Louisiana Supreme Court held in 1954 in California Co. v Price that private ownership of such beds is permissible under state law. The court re-examined the same question in 1975, however, and reversed itself in Gulf Oil Corp. v State Mineral Board. It was held that 'patents purporting to convey the beds of navigable waterways in Louisiana are ineffective'. A short history is given of the development of waterbottom ownership rights in America, as well as of the common law notion of implied sovereignty, which dates back to medieval England. (Frank-Florida)
W77-01078

MODEL WATER RESOURCES PROGRAM,
A. Morse.
Natural Resources Journal, Vol 12, p 388-412 (1972). 25 p, append.

Descriptors: *United States, *Canada, *Water resources development, *International joint commission, *Treaties, Legal aspects, Federal government, Rivers, North Dakota, International commissions, Recreation, Comprehensive planning, Regional development, Resources, Water utilization, River flow, Irrigation, Economic feasibility, Floods, Optimum development plans.
Identifiers: *Pembina River Basin, *International Joint Commission on the Pembina River Basin.

The Pembina River is located 80 miles southwest of Winnipeg, Manitoba, and 160 miles north of Bismarck, North Dakota. It provides the boundry between the United States and Canada. This river has great economic potential for both countries, but at present poor river flow, heavy algae growths, recurrent seasonal flooding, and lack of recreation facilities require such potential to remain dormant. Both the United States and Canada have determined that unilateral projects to improve the river are not economically feasible. A cooperative project is the only way to release the river's vast potential. The Report of the International Joint Commission on the Cooperative Development of the Pembina River Basin concluded that such a combined effort would be economically rewarding to both countries. To counter the problem of which country would control the completed facilities, an international joint commission composed of three members from each country is proposed. The commission would maintain the facilities and determine what use should be made of them. Legal problems arising out of the facilities would be tried in the courts of the country where they arise. Both countries' courts would be freely open to citizens of the other country. (Moorhouse-Florida)
W77-01079

DRIP IRRIGATION: ISRAEL TEACHES CALIFORNIA,
For primary bibliographic entry see Field 3F.
W77-01080

ENERGY AND THE COASTAL ZONE: PULLING AND HAULING AMONG THE FEDS,
L. J. Carter.
The Nation, Vol 220, p 1285-86, 1288, June 27, 1975. 3 p.

Descriptors: *Federal government, *Coastal engineering, *Planning, *Federal jurisdiction, *State jurisdiction, Maine, Washington, Environmental control, Environmental engineering, Shore protection, Shores, Coasts.
Identifiers: *Coastal zone management, *Coastal Zone Management Act.

In 1972 Congress passed the Coastal Zone Management Act (CZMA) to encourage states to reconcile conflicts over land and resource use along the coastal margins. The intent was that the federal government would evaluate only the adequacy of state coastal management processes, and would not dictate the degree of coastal development the states should allow. This has not turned out to be the case, however. The Federal Energy Administration (FEA) and the Energy Research and Development Administration, as well as the Federal Power Commission, are currently taking exception to the first two state coastal zone programs submitted for inter-agency review, namely those of Maine and Washington. Their objection is that the states have an obligation to include in their coastal management plans fairly specific provisions for energy development, even though specific plans for the nation's energy resources have not themselves been devised. The Office of Coastal Zone Management (OCZM) contends that the states are not obligated to designate energy facility sites, even though their failure to do so violates the spirit of the 1972 Act. in short, if no compromise can be reached, the OCZM has only two options: to disapprove plans only where energy provisions are arbitarily left out completely; or to approve inadequate energy plans and run the risk of incurring the energy agencies' wrath. (Frank-Florida)
W77-01081

BURNING WASTES AT SEA--IF THE EPA APPROVES,
For primary bibliographic entry see Field 5G.
W77-01082

OF SLIME AND THE RIVER,
For primary bibliographic entry see Field 5B.
W77-01084

SLUDGE,
For primary bibliographic entry see Field 5G.
W77-01085

CAUGHT IN MID-STREAM: ARMY CORPS OF ENGINEERS,
S. Slade.
The Nation, Vol 221, p 179-81, Sept 6, 1975. 3 p, 1 photo.

Descriptors: *Environmental effects, *Cost-benefit analysis, *Dam construction, *Civil engineering, *Canal construction, Floods, Flood discharge, Flood protection, Flood routing, Barriers, Water storage, Water control, Federal government, Legal aspects, Environmental engineering, Environmental control, Dams, Canals, Cost-benefit theory.
Identifiers: *Environmental impact statement, *National Environmental Policy Act, Administrative regulations.

The Army Corps of Engineers has, in the past, used economic cost-benefit justifications for many of its projects. This method is coming into question as economists and environmentalists around the nation challenge what they contend are inaccurate analyses by the Corps. These analyses once went without scrutiny, but now the whole process of construction has been slowed by the passage of the National Environmental Policy Act of 1970 (NEPA). The Corps is required to file an environmental impact statement (EIS) for each construction project, and hearings are now mandated at every stage of the planning process. This has given environmentalists time to mobilize facts, figures, and the public against agressive water construction projects. Nevertheless, it is questionable whether an unfavorable EIS statement can effectively prevent projects where there is no environmentally safe way to build. In addition, it is unlikely that EIS's will have any impact beyond the particular project since different sections of the country feel differently about the economic and environmental aspects of construction. Thus, until Congress mandates otherwise, the cost-benefit analysis will remain a prime factor in justifying Corps projects. (Frank-Florida)
W77-01086

SHORELAND REGULATION IN WISCONSIN,
Wisconsin Dept. of Natural Resources, Madison.
T. Lauf.
Coastal Zone Management Journal, Vol 2, No 1, p 47-58 (1975). 12 p, 1 fig, 8 ref.

Descriptors: *Comprehensive planning, *Share protection, *State governments, *Wisconsin, Permits, Water resources, Legal aspects, Zoning, Local governments, Regulation, Shores, Short-term planning, Long-term planning, Lakes, Ponds, Streams, Floodplains.
Identifiers: *Water Resources Act of 1966, *Administrative regulations.

Wisconsin's enormous lakefront land area has been used since the 1900's for recreation and for much unplanned development. In order to curb the resulting environmental damage as well as provide for local control of local property, the legislature passed the Water Resources Act of 1966. The bill enables counties to zone all unincorporated areas lying 1000 feet landward of lakes, ponds, and flowages, and to zone 300 feet landward of streams, or the landward side of the floodplain, whichever is greater. In addition, the state also developed standards and criteria for sanitary restrictions and subdivision regulations. These powers have, for the first time, given localities control of those areas closest to them. Developers fought the bill and challenged it in court after its passage. However, the Supreme Court in Just v. Marinette County affirmed the concept of specific shoreland regulation and special permit techniques. Thus, local governments now have the power whether they will use it wisely in formulating rational, planned decisions remains to be seen. (Frank-Florida)
W77-01087

PUBLIC RIGHTS TO ARTIFICIAL WATER-BODIES IN FLORIDA,
Florida Univ., Gainesville. School of Law.
M. Nelson.
Available from Eastern Water Law Center, University of Florida, Gainesville, Florida 32611, for $1.30. (1976), 25 p.

Descriptors: *Public rights, *Florida, *Artificial lakes, *Artificial watercourses, Impoundments, Riparian rights, Land tenure, Navigable waters, Non-navigable waters, Prescriptive rights, Easements, Canals, Recreation, Judicial decisions, Legal aspects, Public access, Navigation, Recreation demands, Social aspects, Reservoirs.
Identifiers: *Public trust doctrine, Navigability tests.

Under Florida law, public rights attach to navigable waters. The increasing need for state control of artificially created bodies of water for recreational and environmental purposes raises the question of whether public rights may be attached to artificial waters. When navigable waters are artificially enlarged or improved, the right of navigation is not limited to the original channels. Public rights, however, do not attach to non-navigable waters made navigable by private landowners. Riparian rights also do not attach to artificial bodies of water but they may be attached through claims of easements, permissive use, dedication, or reservation in deed. Public rights may also be asserted by use of the same doctrines as well as through a claim of recreational navigability. Although not yet accepted in Florida, the recreational use test of navigability may evolve into a means to assert a public claim to artificial waters. The author concludes that increasing public claims on artificial waters may lead to a change in the common law approach. (Capehart-Florida)
W77-01088

UNITED STATES STEEL CORPORATION V SAVE SAND KEY, INC.: A LOSING BATTLE IN THE FIGHT FOR FLORIDA BEACHES,
Florida Univ., Gainesville. School of Law.
T. Mariani.
Available from Eastern Water Law Center, University of Florida, Gainesville, Florida 32611, $1.20. (1976), 28 p.

Descriptors: *Common law, *Florida, *Beaches, *Public access, *Public rights, Land tenure, Population, Legal review, Islands, Coastal structures, Recreation, Prescriptive rights, Judicial decisions, Legislation, Right-of-way, Protection, Social aspects, Oregon, California.
Identifiers: *Standing(Legal), *Nuisance(Legal aspects), Injunctive relief, Prescriptive easements.

Only 277 of the 6,265 miles of Florida beaches are publicly owned. The rapidly expanding population of the state gives rise to a need for the preservation of public beaches and for the establishment of public rights in private beaches. Through use of the unsuccessful litigation by Save Sand Key, Inc., a citizen's group, the author examines the legal theories employed by plaintiffs to establish public rights. The claim of public acquisition of a prescriptive easement is one that is severely restricted by Florida's conservative courts and is seldom successful. Implied dedication of public rights, successfully used in California, is another doctrine which has problems in Florida because of the requirement of proving the intention to dedicate. The English doctrine of custom, used in Oregon to preserve large areas of beach has been accepted by Florida courts. This doctrine, however, was never applied to the Save Sand Key case since the suit failed under a nuisance theory for lack of standing. The author decries the failure of the government to protect Sand Key and concludes that legislation permitting public interest suits for beach protection is necessary. (Capehart-Florida)
W77-01089

THE DEVELOPMENT AND IMPLEMENTATION OF THE COASTAL CONSTRUCTION SETBACK LINE LAW,
Florida Univ., Gainesville. School of Law.
W. M. Sensabaugh.
Available from Eastern Water Law Center, University of Florida, Gainesville, Florida 32611, for $2.25. (1973), 45 p, append.

Descriptors: *Construction, *Coasts, *Florida, *Beach erosion, *Beaches, Oceans, State governments, Environmental effects, Environmental control, Environment, Erosion, Shore erosion, Dunes, Sands, Seashores, Legislation, Legal aspects, Administrative agencies.

In Florida there has been little corporate concern with the problems of beach-front development. In response to a growing interest in beachfront protection, Florida passed the Coastal Construction Setback Line Law. This legislation makes it unlawful to excavate, or to construct any structures within 50 feet of the mean higher water line (MHWL) without first obtaining a permit from the State Department of Natural Resources. This 50 foot limit is hard to administer and enforce, however, because it is difficult to determine accurately the MHWL. Also, the measurement must be taken on the day the owner begins construction, because the owner may in good faith have miscalculated, and a later measurement could put him in violation of the law. Finally, topographic and engineering studies will be required for much of Florida's coasts. Beach changes must also be taken into account. (Frank-Florida)
W77-01090

SOME WATER LAW PROBLEMS ASSOCIATED WITH ESTERO BAY, FLORIDA,
Florida Univ., Gainesville. School of Law.
W. H. Harrell.
Available from Eastern Water Law Center, University of Florida, Gainesville, Florida 32611, for $1.75. (1974), 35 p.

Descriptors: *Florida, *High water mark, *Tidal marshes, *Mangrove swamps, *Grasses, *Boundaries(Property), Shallow water, Salt marshes, Berms, Geomorphology, Water level fluctuations, Seashores, Banks, Ownership of beds, Aquatic plants, Soil-water-plant relationships, Water requirements, Amphibious plants, Aquatic weeds.
Identifiers: Coastal waters, Coastal zone management, Presumptions(Legal), *Estero Bay(Fla).

Stretches of Florida's coastlines, such as the Estero Bay area, present special problems in relation to private and public property determinations. Estero Bay is a protected area not subject to normal wave action and thus has no berms except those caused by storm. The coastal areas of the bay, however, are thick with vegetation making measurement of the mean high water mark difficult and expensive. The prevailing law of state property determination is that if the mean high water mark cannot be determined the federal meander line can be used. The law may have unfortunate results, because often the meander line bears no resemblance at all to the mean high water mark. Estero Bay, like all other vegetated coastal areas, presents its own set of indicators of boundary. The vegetation can be divided into that growing above and that growing below the high water mark. Vegetation will not pinpoint the precise boundary but it can still be used to avoid grossly inaccurate determinations. (Comer-Florida)
W77-01091

LEGAL CONSIDERATIONS CONCERNING OYSTER CULTIVATION IN FLORIDA,
Florida Univ., Gainesville, School of Law.
R. H. Rex.
Available from Eastern Water Law Center, University of Florida, Gainesville, Florida 32611, for $2.75. (1976), 55 p.

Descriptors: *Florida, *Oysters, *Shellfish farming, *Leases, Legislation, State jurisdiction, Federal jurisdiction, Rivers and Harbors Act, Submerged Lands Act, Administration, Regulation, Riparian rights, Permits, Water resources development, Aquiculture, Legal aspects, Water law, Commercial shellfish, Commercial fishing, Crustaceans, Invertebrates, Fishing gear, Fish harvest.
Identifiers: Coastal waters, Coastal zone management, Navigation obstructions, Water rights(Non-riparians), Licenses.

Oysters in the submerged lands of Florida belong to the state in public trust by virtue of the federal Submerged Lands Act. Control of submerged bottom lands and their associated resources is vested in the Division of Marine Resources of the Department of Natural Resources. The law of Florida allows leasing of such resources in accordance with statutory requirements. Two types of leases are available: the lessee may obtain rights only to the submerged bottom land, or he may obtain rights to the bottom and to the water column above. Both leases are limited to the extent of use necessary to accomplish the purpose of the lease. Besides compliance with Florida law and administrative regulations, a lessee must consider federal jurisdiction. In addition, boundary markers of all leased areas must comply with Coast Guard regulation. The Army Corps of Engineers may become involved if obstruction to navigable waters is contemplated. The Corps involvement is most likely in event of aquicultural leases, which include the water column above bottom. (Comer-Florida)
W77-01092

TIDAL BOUNDARIES IN FLORIDA,
Florida Univ., Gainesville.
J. L. Reinman.
Available from Eastern Water Law Center, University of Florida, Gainesville, Florida 32611, for $1.35. (1974), 27 p.

Descriptors: *Florida, *Ownership of beds, *High water mark, *Meanders, *Banks, *Boundaries(Property), Tidal waters, Water levels, Water level fluctuations, Tidal effects, Variability, Coastal marshes, Tidal marshes, Mangrove swamps, Freshwater marshes, Wetlands, Navigable waters, Riparian rights, Real property, Water law.
Identifiers: Coastal waters, Coastal zone management.

Florida law dictates that the boundary line between privately owned uplands and state owned submerged lands along navigable waterways is the 'ordinary high water mark'. A problem of definition results from use of this term, however, because earlier cases in Florida, as well as in other states, have defined the mark in terms of neap tide high water. The federal definition of 'ordinary high water', on the other hand, is determined as the mean high water of all tides, spring as well as neap. Current usage in Florida indicates an adoption of the federal definition, although no definitive statement to that effect has been presented by the courts. A further complication of the high water mark as boundary question is the occasional use of the federal meander line as a boundary. Technically the meander line boundary applies only to swamp and wetlands that are not navigable. The Florida courts, however, use the meander line when navigable waters are bordered by marsh so as to make the high water mark impossible to determine. (Comer-Florida)
W77-01093

FEDERAL REGULATION OF DEVELOPMENT IN FLOOD-PRONE WETLANDS--THE ARMY CORPS OF ENGINEERS,
Florida Univ., Gainesville. School of Law.
R. B. Heyward.
Available from Eastern Water Law Center, University of Florida, Gainesville, Florida 32611, for $0.90. (1975) 18 p.

Descriptors: *Land use, *Flood control, *Regulation, *Federal jurisdiction, *Flood plain insurance, Flood plain zoning, Legislation, Flood plains, Flood protection, State jurisdiction, Flood damage, Non-structural alternatives, Flow control, Floodway, Watershed management, Channel improvement, Administrative agencies, Federal government, Permits, Administrative decisions, Adoption of practices.

The Federal Flood Disaster Protection Act of 1973, together with the National Flood Insurance Act, provides flood protection through combining land use regulation and insurance. The federal program is not entirely effective, however, since 11,000 of the near 15,000 eligible communities had not qualified for insurance protection as of 1974. These flood-prone communities exemplify the need for alternative flood control measures. One alternative is the use of the Army Corps of Engineers as a regulating agency exercising jurisdiction in the area of flood control. The Corps was originally granted jurisdiction over channel and watershed drainage improvements under the Flood Control Act of 1944. The jurisdiction was enlarged to include land use planning under the Watershed Protection and Flood Prevention Act. To date the Corps has limitedly exercised jurisdiction, and no congressional mandate requires the Cors to act. In fact the federal insurance program seems to support the Corps' reluctance. Thus, if insurance is ineffective, other measures are required. (Comer-Florida)
W77-01094

A STUDY OF VARIOUS STATE FLOOD PLAIN REGULATIONS IN AN EFFORT TO EMPHASIZE FLORIDA'S NEED TO EXACT COMPREHENSIVE PLANNING AND LAND USE CONTROLS, WHICH ARE DESIGNED TO AFFORD PROTECTION AGAINST HURRICANE DAMAGE,
Florida Univ., Gainesville. School of Law.
R. Herold.
Available from Eastern Water Law Center, University of Florida, Gainesville, Florida 32611, for $1.35. (1974), 27 p.

Descriptors: *Florida, *Hurricanes, *Flood damage, *Southwest U.S., *Flood plain zoning, Arizona, Utah, Nevada, Texas, California, Hurricanes, Shore protection, Coastal structures, Land use, Building codes, Legislation, Regulation, Safety factors, Buildings, Standards, Permits, Legal aspects.

Florida has had, in the last 25 years, massive coastline development. As yet, none of the recent construction has been tested by a '100 year flood' or even by very severe hurricanes such as those of the 1920's and 1940's. The state must, to protect all of its inhabitants, formulate and implement a flood plain planning program to prevent excessive construction in flood prone areas and to protect the beach dune areas which provide protection from hurricanes. Nevada, Arizona and Utah, have recently enacted such flood plain planning programs aimed at increasing protection from and conservation of flood waters. The needs of these states, however, are very different from Florida's needs. California and Texas have implemented programs for protection of coastal communities. Texas' program is of special interest to Florida because Texas is also prone to hurricane damage. Unlike Florida, Texas has received recent severe flood damage. Florida should take heed and establish comparable protection before similar harm is done. (Comer-Florida)
W77-01095

USE OF BUILDING CODES: TO REGULATE FLORIDA'S HURRICANE FLOOD PLAIN,
Florida Univ., Gainesville. School of Law.
J. M. Hess.
Available from Eastern Water Law Center, University of Florida, Gainesville, Florida 32611, for $1.65. (1976), 33 p.

Descriptors: *Flood control, *Florida, *Flood plain zoning, *Building codes, *Constitutional law, Flexible foundations, Design standards, Construction material, Flood damage, Legislation, Regulation, Safety factors, Permits, Land use, Buildings, Standards, Legal aspects.

One of the most controversial methods of flood plain management is land use regulation. This method is also the most effective management plan. Flood plain zoning which prevents construction of all or of certain types of buildings runs the greatest risk of constitutional challenge. Florida has yet to consider the issue but court reaction to prohibitive zoning in other states has been mixed. Serveral such ordinances have been found to be unconstitutional takings. Another measure which is less open to the taking argument is use of building codes. If this measure is adopted the only really effective program would have to include codes requiring alteration of existing structures as well as construction regulations for new structures. Building codes are subject to equal protection challenges. Furthermore, the financial problems, particularly with regard to existing structures, may be immense. Such difficulties can be overcome, however, and such program have had good results where implemented. (Comer-Florida)
W77-01096

DRAWING THE LINE AT THE OCEANFRONT, THE ROLE OF COASTAL CONSTRUCTION SET-BACK LINES IN REGULATING DEVELOPMENT OF FLORIDA'S COASTAL ZONE,
Florida Univ., Gainesville. School of Law.
A. J. O'Donnell.
Available from Eastern Water Law Center, University of Florida, Gainesville, Florida 32611, for $2.00. (1976). 40 p.

Descriptors: *Florida, *Shore protection, *Coastal structures, *Beach erosion, *Littoral drift, *Accretion(Legal aspects), High water mark, Flood control, Sea walls, Dune sands, Wind erosion, Dunes, Legislation, Building codes, Permits, Administrative decisions, Regulation, Planning, Constitutional law, Legal aspects, Land use.
Identifiers: Coastal zone management, Coastal waters.

To prevent danagerous and excessive occurences of floods and beach erosion, the state of Florida has established a system of set back lines. Originally the interim line for all beaches was set at 50 feet from the mean high water mark, but no closer than allowed by local ordinances. Since the interim line was established the state has undertaken studies of different beach areas and has set permanent set back lines for each beach as determined by local flooding and erosion problems. Local ordinances, if stricter, must also be complied with under state law. Variances from the set back requirements are possible but involve potential conflicts with local and federal regulation. Thus, few variances are granted. Set back legislation has not been a real problem in relation to the taking issue that has plagued coastal zoning. However, while set back laws provide sufficient flood and erosion coastal protection, coastal zoning protects coastal vegetation as well. (Comer-Florida)
W77-01097

URBAN STORM WATER RUNOFF: A TWO-FOLD PROBLEM,
Florida Univ., Gainesville. School of Law.
D. Fernandez.

Available from Eastern Water Law Center, University of Florida, Gainesville, Florida 32611, for $2.45. (1976), 49 p.

Descriptors: *Storm runoff, *Cities, *Storm drains, *Urbanization, *Surface runoff, Storm water, Water pollution sources, Riparian rights, Surplus water, Depression storage, Impoundments, Ponding, Retention, Watershed management, Surface groundwater relationships, Water law, Legal aspects, Constitutional law.

Storm water runoff is a serious problem in urban areas and may constitute a significant source of water pollution. The solution to storm water runoff difficulties seems to be the detention of waters in higher lands for longer periods, coupled with drainage improvements in lower areas. Detention of water in upper land areas, however, involves the possibility of constitutional taking of property. In addition, increased drainage on lower lands often requires costly acquisitions of flood easements over private property. Flood insurance legislation has led to a new awareness of flood plain zoning, and the local responses indicate that the problems can be solved. Flood water pollution is another matter. Zero pollution goals prevent runoff into waterways but detention of water often results in pollution of groundwater. Probably technological advances will provide a solution. (Comer-Florida)
W77-01098

THE NATIONAL FLOOD INSURANCE ACT OF 1968 AND FLOOD PLAIN ZONING IN ARKANSAS, NEBRASKA, NORTH DAKOTA, MISSISSIPPI, TENNESSEE, SOUTH DAKOTA, AND KANSAS,
Florida Univ., Gainesville. School of Law.
P. A. Rasmussen.
Available from Eastern Water Law Center, University of Florida, Gainesville, Florida 32611, for $1.60. (1976), 32 p.

Descriptors: *Central US., *Design standards, *Flood control, *Federal government, *Flood plain zoning, Nebraska, North DAkota, Mississippi, Tennessee, South Dakota, Kansas, Legislation, State jurisdiction, Flood data, Flood damage, Flood plain insurance, Flood plains, Land use, Building codes, Foundations, Safety factors, Regulation, Permits, Legal aspects.

The National Flood Insurance Act of 1968 is essentially a voluntary program. Communities and states wishing to take advantage of the Act must show that flood control programs meeting minimum federal standards have been implemented. The various states have faced flood control in different ways. Arkansas, for instance, provides by statute that each community may enact legislation. If local laws fail to meet federal requirements, however, the state may provide stricter standards. Nebraska has provided its communities with minimum standards and model ordinances all complying with federal law. North Dakota allows farm buildings in flood plain areas while Mississippi does not. North Dakota's law is, therefore, federally in-adequate and dangerous. Comparison of the above plans with those of other states such as Tennessee, South Dakota, and Kansas shows the strengths and weaknesses of each and may suggest the best method to be used by other states. (Comer-Florida)
W77-01099

REDEVELOPMENTS ON THE OCEANFRONT,
Florida Univ., Gainesville. School of Law.
N. A. Pope.
Available from Eastern Water Law Center, University of Florida, Gainesville, Florida 32611, for $2.40. (1976), 48 p.

Descriptors: *Permits, *Florida, *Hurricanes, *High water mark, *Structures, Tides, Coasts, Buildings, Construction, Riparian rights, Accretion(Legal aspects), Erosion, Avulsion, Beds, Damages, Watercourses(Legal aspects), Tidal waters, Ownership of beds, Boundaries(Property), Navigable waters, Coastal structures.
Identifiers: Public trust doctrine.

Private ownership of oceanfront property carries certain rights and restrictions as regards development of the property. Once the property has been developed, the question may arise as to whether such development may be restored if it is partially or wholly destroyed. The author examines the issues involved in Florida in rebuilding structures damaged or destroyed by hurricanes, including the problem that arises when the mean high water line has been moved shoreward of the structure by tidal action. The applicable state and federal laws are reviewed and pertinent case decisions are discussed. Various arguments open to the land owner are examined. In most cases permission to rebuild would depend on a combination of factors, including nearness to the mean high water line, the possible environmental damage, and the potential for interference with public rights. (Capehart-Florida)
W77-01100

WATER MANAGEMENT AND ADMINISTRATION IN THE SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT,
Florida Univ., Gainesville. School of Law.
C. Hardee.
Available from Eastern Water Law Center, University of Florida, Gainesville, Florida 32611, for $3.70. (1976), 74 p, 7 tab, 1 fig, 3 append.

Descriptors: *Water management(Applied), *Florida, *Well regulations, *Well permits, Wells, Legislation, Administrative agencies, Water use, Water law, Drilling, Water sources, Water resources, Water resources development, Permits, Groundwater, Groundwater resources, Groundwater potential, Management.
Identifiers: *Florida Water Resources Act of 1972.

A landowner faces many problems in building a water well field for municipal supply. Specifically, the landowner is concerned with possible legal consequences of the lowering of lake and ground water levels which may result from his pumping activities. As a preliminary guide to understanding the problem, background principles of groundwater hydrology and geology are given in condensed form. The common law development of groundwater rights is then examined, as well as statutory modifications of that doctrine in Florida. Special emphasis is placed on the water management policies of the Southwest Florida Water Management District (SWFWMD) and on the rules and regulations of the Florida Water Resources Act of 1972. To provide a brief overview of SWFWMD administrative procedures, a case study in water management and administration is presented, using the District's rules and regulations as parameters for a well construction problem. Finally, a sample application package for SWFWMD consumptive use permits is presented.
W77-01101

COASTAL CONSTRUCTION AND OTHER PHYSICAL ACTIVITIES SEAWARD OF THE MEAN HIGH WATER LINE,
Florida Univ., Gainesville. School of Law.
T. Tomasello.
Available from Eastern Water Law Center, University of Florida, Gainesville, Florida 32611, for $3.70. (1976), 74 p, 3 fig, 2 append.

Descriptors: *Landfills, *Construction, *Florida, *Dredging, *Permits, Coasts, Erosion, Shore protection, Tidal effects, Waves(Water), Seashores, Oceans, Sand bars, Sand spits, Legislation, Beach erosion, State governments, Local governments.
Identifiers: *Coastal zone management, *Coastal waters, *Licenses.

Florida and federal legal problems associated with two different types of proposed coastal construction are explored, with the emphasis placed on state regulation. A hypothetical situation is posed in which a hotel owner wishes to increase his beach area by either constructing a groin or extending his upland seaward by means of dredging and filling. The complexities of such an operation have grown considerably in that government has become more concerned with the coastal environment. To illustrate this increased government involvement, a history of Florida regulations concerning coastal lands, as well as a discussion of the trust doctrine and the interpretation of 'public interest' is presented. Regulatory schemes presently in force in Florida are also discussed. They are broken down separately to cover groin construction and dredge and fill activities. Today in Florida as many as nine state and federal permits may be required for the project. However, because the hotel owner will probably not be able to demonstrate that the construction will benefit the public interest, it is unlikely that the permits will be issued. (Frank-Florida)
W77-01102

COMMISSION FOR OCEAN ADVANCEMENT THROUGH SCIENCE AND TECHNOLOGY.
Alas Stat Ann secs 46.26.010 thru 46.26.100 (1971).

Descriptors: *Water resources development, *Administrative agencies, *Alaska, *Water allocation(Policy), *Project planning, Beneficial use, Water pollution control, Water quality, Water supply, Regulation, Programs, Project feasibility, Social function, Water management(Applied), Environmental effects, Legislation, Environmental control, Project purposes, Local governments, Social impact, Alternative planning.

Alaska has enacted legislation creating in the Office of the Governor the Commission for Ocean Advancement Through Science and Technology. The Commission's purpose is to develop a comprehensive state plan for the orderly, long range conservation and development of marine and coastal resources. This will ensure their wise multiple use in the public interest. Commission members are empowered to implement the plan. To begin, the Commission shall undertake a comprehensive investigation and study of all aspects of the marine sciences and the marine and coastal environment in and proximate to the state, including: (1) a review of the known and estimated future needs for natural resources from the marine and coastal environment; (2) a survey of all significant existing and planned marine science activities in the state; (3) a determination of what the state policies, programs and laws should be regarding all social, economic, and legal matters relative to the conservation and utilization of ocean resources; and (4) a determination of the surveys, applied research programs and ocean engineering projects required to obtain the needed natural resources from the marine and coastal environment. (Lauer-Florida)
W77-01103

COMMISSION ON THE CONFERENCE OF THE LAW OF THE SEA.
Alas Stat Ann secs 44.19.789 thru 44.19.799 (1967).

Descriptors: *Alaska, *Resources development, *Natural resources, *Legislation, *Law of the sea, Conferences, State governments, Mineralogy, Oil, Natural gas, Fish, Shellfish, Administrative agencies, Jurisdiction, Legal aspects, Grants, Beds, Coasts, Oceans, Governmental interrelations, State jurisdiction, Conservation.

The Alaska legislature has created a seven member commission on the Conference of the Law of the Sea. The commission has the responsibility for compiling and analyzing data on resources in the sea or seabed off the Alaskan coast. It is also charged with development of state

positions on management, utilization and conservation of marine resources such as minerals, oil and gas, and fish and shellfish. It is also charged with the establishment of maximum jurisdictional limits for the state. The commission has a further duty of assuring fair representation for the state in the 1973 Conference on the Law of the Sea and subsequent conferences. The commission is also authorized to enter into agreements with other coastal states for the development and conservation of marine resources. (Capehart-Florida)
W77-01104

PUBLIC LANDS (LEASING OF MINERAL RIGHTS IN STATE OWNED TIDAL AND SUBMERGED LANDS).
Alas Stat Ann secs 38.05.250 thru 38.05.255 (1973).

Descriptors: *Alaska, *Mining, *Beds, *Permits, *Leases, Exploration, Mineralogy, State governments, Administrative agencies, Mills, Rent, Timber, Mine wastes, Ownership of beds, Bids, Contract administration, Legal aspects, Legislation, Contracts, Tidal marshes.
Identifiers: *Tidelands.

The right to explore tide and submerged state lands for minerals may be granted by a permit. The maximum area of exploration is 2,560 acres with rental paid on a per acre basis. Such rental may be offset by useful expenditures on the permitted land. Under a prospecting permit, limited amounts of minerals may be mined for purposes of sampling and testing. If minerals are discovered, the permit holder may acquire a non-competitive mineral lease for that portion of the permitted land shown to contain mineral deposits. Submerged lands containing known deposits may be leased by competitive bids. Mineral leases are for a maximum term of 55 years with a yearly rental of $1/acre adjustable every 20 years. Surface uses of land or waters by the owner of the mineral rights shall be limited to those uses necessary to exploration, mining, or processing. Permits may be granted for millsites and tailings disposal. (Capehart-Florida)
W77-01105

PUBLIC LANDS (PREFERENCE RIGHTS ESTABLISHED FOR ACQUISITION OF TIDELANDS AND SUBMERGED LANDS).
Alas Stat Ann secs 38.05.320, 38.05.365 (1973).

Descriptors: *Alaska, *Preferences(Water rights), *Boundaries(Property), *Ownership of beds, Public access, Priorities, State governments, Cities, Beds, Seashores, Tidal waters, Leases, Right-of-way, Navigation, Real property, Land tenure, Legislation, Legal aspects.

The Alaska legislature is establishing preference rights for the acquisition of tidelands and submerged lands occupied or developed prior to the date of statehood. Cities may apply for a conveyance from the state of submerged lands seaward of the city. Preference rights are classified for occupants of land conveyed to the cities by the state. Cities conveying submerged lands to occupants shall convey additional unoccupied land where reasonably necessary for the use and enjoyment of the occupied land unless development of the land would interfere with navigation. Cities may sell or lease tidelands if no preference right has been granted for them. Rights-of-way shall be reserved if necessary to provide access to public waters. Preference rights are classified for occupants of submerged lands not seaward of a city. (Capehart-Florida)
W77-01106

UNITED STATES V KAISER AETNA (DEVELOPMENT CHANGING NATURE OF POND FROM PRIVATE TO SUBJECT TO PUBLIC NAVIGATION SERVITUDE).
408 F Supp 42-55 (D Ha 1976). 14 p.

Descriptors: *Hawaii, *Judicial decisions, *Navigabile waters, *Public access, Easements, Public rights, Excavation, Construction, Landfills, Riparian rights, Navigation, Rivers and Harbors Act, Federal government, Water law, Permits, Control, Legal aspects, Water policy, Water rights, Legislation.
Identifiers: *Water rights(Non-riparians), *Navigational servitude.

Plaintiff United States sought a declaratory judgment that the waters of defendants' pond, generally known as Hawaii-Kai Marina, were navigable waters of the United States and that defendants were, therefore, required to obtain authorization for any construction, excavation, or filling. Plaintiff also sought an injunction to prevent the defendants from interfering in any way with public access to the waters of the marina. The U. S. District Court held that fishponds in Hawaii are of a private nature, and ownership of such ponds includes the right to exclude the public. However, since the marina was used in interstate commerce and had become the legal equivalent of a toll-charging channel or harbor, it was subject to regulation by the Corps of Engineers under the Rivers and Harbors Act, as well as to improvement and regulation for navigation. Thus a public navigation servitude could be imposed upon the privately constructed waterway after paying reasonable compensation. (Reinders-Florida)
W77-01107

COUNTY AND MUNICIPAL POLLUTION CONTROL FACILITIES.
Ark Stat Ann secs 13-1901 thru 13-1903, 13-1912 (Cum Supp 1975).

Descriptors: *Treatment facilities, *Arkansas, *Legislation, *Water policy, *Water pollution treatment, Water quality control, Air pollution, Sewage, Chemical wastes, Domestic wastes, Industrial wastes, Municipal wastes, Water pollution, Pollution abatement, Water quality standards, Environmental sanitation, Environmental engineering.

Arkansas has enacted legislation providing for county and municipal pollution control facilities. Pollution control facilities have been determined to be essential to promote the health, safety and physical welfare of the state and to secure the development of industry. Therefore, any municipality or county is authorized to own, acquire, construct, equip, improve, maintain, sell, lease, contract or otherwise deal in facilities for the disposal or control of sewerage, water pollution or air pollution. To obtain the permanent financing necessary to accomplish pollution control, municipalities and counties are authorized to expend any available revenues and to issue bonds of the amount necessary for payment of any costs, including incidental costs. This act is intended for liberal construction, but nothing in this act is to be construed to authorize any municipality or county to sell bonds or to use the proceeds to condemn or purchase any distribution system controlled by a regulated public utility. (Comer-Florida)
W77-01108

WATER RIGHTS REGISTRATION.
Ariz Rev Stat Ann secs 45-180 thru 45-193 (Supp 1975).

Descriptors: *Arizona, *Legislation, *Water rights, *Appropriation, *Prescriptive rights, Relative rights, Administrative agencies, Competing uses, Water allocation(Policy), Water contracts, Water utilization, Water consumption(Except Consumptive use), Consumptive use, Water permits, State jurisdiction, Water law.
Identifiers: *Water rights(Non-riparians).

Arkansas has enacted legislation providing that any person, partnership, association, public or private corporate state or subdivision agency or municipality claiming right to use or withdraw any water from any source for domestic, municipal, recreational, wildlife, agricultural, power, mining or stockwatering use must file claim of that right in proper form. Failure to file the claim constitutes relinquishment of the right but does not constitute any adjudication of any conflicting claim. The filing requirement does not apply to any water rights issued pursuant to permit, to rights acquired by contract with the federal government, or to rights to use Colorado River waters. To insure that affected persons are properly notified of filing necessity, proper publication of notice is required. A water claims registry shall be established to receive such claims. No adverse possession of water rights shall exist since establishment of claims is by filing only. If it appears that anyone having right to use waters fails in whole or in part to use the permitted amount, the unused portion shall be subject to appropriation. (Comer-Florida)
W77-01109

DEPARTMENT OF NATURAL RESOURCES V ELDRIDGE R. FRANCE (ESTABLISHMENT OF COUNTY BOUNDARY AS THALWEG INSTEAD OF GEOGRAPHIC CENTER OF RIVER).
357 A2d 78-99 (Md Ct App 1976). 22 p.

Descriptors: *Maryland, *Boundaries(Property), *Rivers, *Thalweg, *Oysters, Ownership of beds, Non-navigable waters, Harvesting, Judicial decisions, Jurisdiction, Law enforcement, Channels, Navigable waters, Constitutional law, Legislation, Boundary disputes, Local governments, Charts, Maps, Hydrolgraphs.
Identifiers: *Wicomico River(Md).

Plaintiff state agency brought charge against defendant oysterman for unlawful oyster dredging in the Wicomico River. The charge was subsequently dismissed for lack of jurisdiction in the county where the charge was brought. For venue purposes, plaintiff then sought a judicial determination of the boundary line between two counties separated by a navigable river. The trial court decision, which was affirmed at the first appellate level, held that the boundary line was the geographic center of the river as shown on county topographic maps. The Court of Appeals of Maryland, however, held that the boundary line is the thalweg or midline of the main river channel and that the proper maps were the hydrographic charts. In an extended opionion, the court examined United States Supreme Court decisions and the decisions of a number of state courts as they pertain to river boundaries. (Capehart-Florida)
W77-01110

KELLY RANCH V SOUTHEASTERN COLORADO WATER CONSERVANCY DISTRICT (PLAN OF AUGMENTATION BY DEVELOPER).
550 P2d 297-308 (Colo 1976). 12 p.

Descriptors: *Colorado, *Water supply development, *Water allocation(Policy), *Water districts, *Water supply, Water conservation, Water distribution(Applied), Water management(Applied), Well permits, Well regulations, Water rights, Water permits, Water policy, Water resources, Water resources development, Water users, Consumptive use, Planning.

Plaintiff residential developer had sought approval of a plan to increase his supply of water by development of new or alternate means of water resources. The plan was rejected by the water court and the plaintiff appealed. The plan for augmentation called for the developer to remove permanently 14 acres of native pasture and to use the water which had historically been used for irrigation of that acreage to replace water to be consumptively used in the proposed residential development. The plan also provided for storing

some of the water normally used in the irrigation season for year-round use to prevent injury to wells in the area. The defendant water district contended that any acceptable plan for augmentation required the addition of new water into the water system. The Supreme Court of Colorado held that new water need not be injected into the water system to validate a plan for augmentation. Since the plaintiff had met his burden of proving that the amount of return flow from in-house use of the well water was as stated and since possible pollution effects of the plan were not at issue, the court approved the augmentation plan. (Welch-Florida)
W77-01112

CLOVERLEAF FARMS, INC V SURRATT (COMMON ENEMY DOCTRINE: SURFACE WATER).
349 NE2d 731-32 (Indiana Ct App 1976). 2 p.

Descriptors: *Indiana, *Adjacent land owners, *Dams, *Alteration of flow, *Judicial decisions, Discharge(Water), Legal aspects, Common law, Standing waters, Surface waters, Damages, Construction, Flow augmentation, Flood damage, Flood discharge, Land.
Identifiers: *Common Enemy Doctrine.

Plaintiff property owner sought damages for change of drainage of surface water caused by construction by defendant adjacent land owner. The plaintiff contended that the defendant's housing construction had caused surface water which had previously flowed across its own land to stand on plaintiff's land. The defendant contended that as a landowner it was not liable for damages arising from a change in the flow of surface water occasioned by alterations on its own land. In reversing the lower court and finding for the defendant, the First District Court of Appeals of Indiana relied on the 'Common Enemy Doctrine' that lower property owners may dam against surface water to prevent its flowing onto their land and thus cannot be held liable for damages resulting from the accumulation of water above the construction or because such obstruction causes the water to flow onto the lands of others. The court noted an exception to the doctrine to the effect, that a land owner may not collect water in a body and then discharge it onto another's land. (Rieck-Florida)
W77-01113

STATE EX REL BROWN V ROCKSIDE RECLAMATION (STATUTE PROVIDING FOR GRANTING OF PERMITS RELATING TO WATER POLLUTION CONTROL--APPLICATION).
351 NE2d 448-54 (Ohio 1976). 7 p.

Descriptors: *Ohio, *Water permits, *Public health, *Water pollution control, *Water quality control, *Odor, Air pollution, Odor-producing algae, Public rights, Water quality standards, Legal aspects, Judicial review, Administrative agencies, Waste treatment, Waste disposal, Solid wastes, Water injury.
Identifiers: *Administrative regulations, *Nuuisance(Legal aspects).

Plaintiff attorney general brought this action in nuisance to enjoin defendant solid waste disposal site operator from operating its disposal site. The plaintiff alleged that the defendant was depriving citizens of the beneficial use of state waters and was giving off odors in violation of state law. The Ohio Supreme Court held that the statute relating to offensive smells as being injurious to public health and comfort was a general nuisance provision and was not applicable to a duly licensed solid waste disposal operation. When the legislature authorizes acts to be done which previously would have constituted a nuisance, such acts no longer are legally a nuisance insofar as the public is concerned. The court further found that the defendant as a solid waste disposal operation, did not place any waste into any body of water or upon any bank. Finally, the statute providing for permits relating to water pollution regulation did not control because the site was licensed by the director of the Environmental Protection Agency; therefore, its operation would follow prescribed Agency's procedures. (Welch-Florida)
W77-01114

COUNTRY KNOLLS WATER WORKS, INC V REID (LIMITATION OF OUTPUT OF PRIVATE WATER SUPPLIER'S WELL).
383 NYS2d 661-65 (App Div 1976). 5 p.

Descriptors: *Well permits, *New York, *Well regulation, *Well data, *Water management(Applied), Wells, Water control, Water storage, Water conveyance, Water permits, Regulation, Water pollution control, Water pressure, Legal aspects, Permits, Administrative agencies, Pipes, Pumping.
Identifiers: *Administrative regulations, Evidence.

Plaintiff private water supplier brought this action to review the determination by defendant commissioner of the Department of Environmental Conservation which modified plaintiff's application to expand his water system, thereby limiting the output of plaintiff's well. The plaintiff sought application for the approval of two new wells, but the application was denied on the grounds that inadequate information was available concerning possible environmental effects of such construction. The plaintiff contended that the challenge was not based on substantial evidence. The court held that a private water supplier could not be required to maintain minimum water pressure throughout the consumer's system. In this case, though, rationality being the test to find substantial evidence, the commissioner was justified in limiting plaintiff's output. The court then went on to state that the storage capacity requirement must be based upon design average consumption and not upon peak demand consumption. (Welch-Florida)
W77-01115

LEASES OF LAKES, PONDS, STREAMS AND RESERVOIRS.
Okla Stat Ann, tit 11, secs 321 thru 322 (1959).

Descriptors: *Fish establishment, *Oklahoma, *Leases, *Lakes, *Recreation, Ponds, Streams, Reservoirs, Local governments, Cities, Legislation, Water supply, Hunting, Fishing, Commercial fishing, Public access, State government, Legal aspects, Water utilization, Fish hatcheries, Fisheries.

Municipalities in the state of Oklahoma which own or control lakes or watercourses for water supply purposes may lease or issue licenses for the use of these bodies of water for hunting, fishing, or the propagation of fish. The maximum period for such a lease will be ten years. If the terms of the lease allow the public free hunting and fishing privileges, however, the maximum period may be for twenty-five years. No lease shall be issued to allow the propagation of fish for commercial purposes. (Capehart-Florida)
W77-01116

WATER POWER COMPANIES--EMINENT DOMAIN,
Okla Stat Ann tit 27, sec 4 (1958).

Descriptors: *Oklahoma, *Eminent domain, *Hydrolelectric plants, *Sites, *Dams, Non-navigable waters, Streams, Water storage, Right-of-way, Flumes, Conduits, Water conveyance, Electric power, Transmission lines, Transmission(Electrical), Powerline carriers, Facilities, Conveyance structures.

The power of eminent domain granted to any water power company in the state of Oklahoma to acquire sites to erect power plants and dams over non-navigable streams, and to acquire sites for water storage. The power of eminent domain is also granted to these companies for the purpose of acquiring rights-of-way for water conveyance structures and electrical transmission systems. (Capehart-Florida)
W77-01117

MINING AND MANUFACTURING CORPORATIONS.

Descriptors: *Oklahoma, *Mineral industry, *Ditches, *Water utilization, Mining, Flumes, Tunnels, Right-of-way, Diversion, Damages, Mills, Irrigation, Streams, Water conveyance, Priorities, Mineralogy, Excavation, Mining engineering, Diversion structures, Routing, Legislation.

The articles of incorporation of a corporation formed to construct a ditch to carry water to any mines or mills or to lands for irrigation must specify the stream and the place on the stream from which water is to be taken, the line of the ditch, the intended use of the water, and the route and purpose of any flume. Ditch corporations are given the right-of-way over the ditch line and the right to divert stream waters through the ditch so long as there is no interference with pre-existing ditches or water rights. The ditch must be constructed and maintained so that water will not escape and injure any property. Corporations formed to construct mining tunnels must specify the course of the tunnel and the minerals to be excavated. Any corporation which fails to commence construction within 90 days or complete its work within two years shall forfeit all right to the route. (Capehart-Florida)
W77-01118

WATER AND WATER RIGHTS,
Cal Const Art 14 secs 1,3,4.

Descriptors: *Beneficial use, *California, *Water rights, *Riparian rights, *Land tenure, Appropriation, Public use, Constitutional law, Water conservation, Water resources, Conservation, Diversion, Regulation, Federal government, Legal aspects, Legislation, Streams, Governments.

California has enacted legislation providing that the use of appropriated water is a public use subject to conserve and preserve the water resources of the state. Thus, a riparian land owner has the right to reasonable use of stream waters adjacent to his property if he utilizes reasonable diversion methods. However, riparian rights in a stream only attach to so much of the flow of water as is required for a reasonable use of the land. Furthermore any governmental agency which acquires an interest in real property in the state must conform to the state laws regarding the acquisition, control, use, and distribution of water with respect to the land so required. (Capehart-Florida)
W77-01119

NAVIGABLE WATERS (DEFINITION, ENUMERATION AND OFFENSES).
Cal Harbors and Navigation Code Ann secs 90 thru 152 (West 1955), as amended, (Supp 1976).

Descriptors: *California, *Navigable waters, *Penalties(Legal), *Public access, *Legislation, Coasts, Streams, Transportation, Trespass, Rivers, Harbors, Sawdust, Wastes, Oil, Trees, Navigation, Negligence, Legal aspects.
Identifiers: *Navigation obstructions, Oil spill cleanup.

California has enacted legislation providing that streams large enough for the transportation of commercial products are to be deemed public ways for navigational purposes. However, when a

navigable course is in floodstage, the waters flowing outside the established boundaries of the watercourse are not navigable. The navigable waters of the state are enumerated and the extent of navigability of each is described. Unlawful acts with regard to navigable waters include: the obstruction of navigable waters by felling trees; any obstruction of navigable waters; the dumping of ballast into a harbor; the non-emergency or non-accidental discharge by a vessel of fuel oil into navigable waters; and the depositing of sawdust or refuse in Humboldt Bay. A civil penalty is etablished for the intentional or negligent discharge of oil into any state waters and liability is imposed for clean up costs. (Capehart-Florida)
W77-01120

WATER POLLUTION PROHIBITED.
Cal Fish and Game Code Ann secs 5650 thru 5803 (West 1958), as amended, (Supp 1976).

Descriptors: *California, Water pollution, *Legislation, *Water pollution control, *Public health, Pollution, Oil, Wastes, Sawdust, Industrial wastes, Toxicity, Sewage wastes, Water quality control, Shellfish, Administrative agencies, Law enforcement, Inspection, Mine wastes, Hydraulic mining, Rivers, Permits, Dredging, Abatement.

California has enacted legislation for the purpose of preventing and controlling water pollution. Prohibitions are placed on the deposit or discharge into state waters of certain substances including industrial wastes, factory refuse, petroleum products or residues, and other materials harmful to fish, plant or bird life. The dumping of cans, bottles, garbage, and junked vehicles into state waters is also prohibited. Correction of chronic water pollution conditions is the responsibility of regional water pollution control boards. Permits from the Department of Fish and Game are required for the use of dredge equipment in state waters. The Department of Public Health is responsible for the inspection of shellfish beds. If the beds are contaminated so that public health would be endangered by their use, the department is required to prevent and to post notices prohibiting the taking of shellfish from the area. Also, mining operations in the Trinity and Klamath River Fish District are to be conducted so as to prevent the pollution or contamination of the waters in the district from July through November. (Capehart-Florida)
W77-01121

POLLUTION OF NAVIGABLE WATERS.
Cal Health and Safety Code Ann secs 4400 thru 4468 (West 1970), as amended (Supp 1976).

Descriptors: *California, *Waste disposal, *Navigable waters, *Legislation, *Water supply, Radioactive waste disposal, Boats, Penalties(Legal), Water pollution, Public health, Inspection, Sewage disposal, Law enforcement, Septic tanks, Livestock, Swimming, Waste disposal wells, Aquifers, Reservoirs, Fishing, Permits, Grazing.
Identifiers: Houseboats, Nuisance(Legal aspects), Injunctive relief, Ocean dumping, Ocean disposal.

California has enacted legislation prohibiting the dumping of garbage into navigable waters of the state. It is a misdemeanor to load or to permit garbage to be loaded on a vessel for dumping in navigable waters. Procedures are established for the carrying of a health inspector by vessels engaged in ocean disposal of garbage or radioactive wastes. Furthermore, vessels operating in navigable waters or tied to a dock having toilet facilities shall not discharge any human excreta into navigable waters. Activities which cause or might cause contamination of a stream, pond, lake or reservoir serving as a source of water supply are prohibited. Such activities include bathing, washing clothes, septic tank drainage, or livestock pollution. However, public fishing may be allowed on publicly owned reservoirs used for drinking water purposes if the water quality is not affected and if permitted by the State Department of Health. (Capehart-Florida)
W77-01122

MILLER ANTI-POLLUTION ACT OF 1971 (ABSOLUTE LIABILITY OF PETROLEUM CARRIER).
Cal Harbors and Navigation Code sec 293 (West Supp 1976).

Descriptors: *Boats, *Navigable waters, *California, *Oil spills, *Transportation, *Oil industry, Ships, Damages, Natural resources, Marine biology, Wildlife, Navigable waters, Jurisdiction, Oceans, Governments, Oil pollution, Water pollution, Water pollution sources, Legislation.
Identifiers: *Absolute liability.

California has enacted legislation providing that the owner or operator of any vessel which transports petroleum or fuel oil on a commercial basis shall be absolutely liable without regard to fault for any property damage within the state. Furthermore, such owner or operator shall be liable for any damage or injury to the natural resources of the state which is caused by the discharge or leakage of petroleum or fuel oil from the vessel into the navigable waters of the state. Such liability is imposed when the damage is caused directly or proximately by acts of the owner or operator and not when the cause can be attributed to the actions of another agency which were not foreseen or foreseeable. (Capehart-Florida)
W77-01123

HISTORY AND DEVELOPMENT OF MULTIPLE OBJECTIVE PLANNING FOR WATER RESOURCES,
Water Resources Council, Washington, D.C.
For primary bibliographic entry see Field 6B.
W77-01152

THE ATTITUDE AND INTEREST OF THE ENVIRONMENTAL PROTECTION AGENCY IN MULTIPLE OBJECTIVE PLANNING OF WATER AND RELATED LAND RESOURCES,
Environmental Protection Agency, Washington, D.C. Office of Water Planning and Standards.
For primary bibliographic entry see Field 5G.
W77-01153

EMERGING CORPS OF ENGINEERS GUIDELINES FOR IMPLEMENTING THE PLANNING REQUIREMENTS OF WRC'S PRINCIPLES AND STANDARDS AND RELATED POLICIES,
Corps of Engineers, Washington, D.C. Planning Div.
For primary bibliographic entry see Field 6B.
W77-01154

IMPLEMENTATION OF MULTIPLE OBJECTIVE PLANNING BY THE SOIL CONSERVATION SERVICE,
Soil Conservation Service, Washington, D.C. River Basin.
For primary bibliographic entry see Field 6B.
W77-01155

PHILOSOPHY OF MULTIPLE OBJECTIVE PLANNING IN THE BUREAU OF RECLAMATION,
Bureau of Reclamation, Washington, D.C.
For primary bibliographic entry see Field 6B.
W77-01156

THE TENNESSEE VALLEY AUTHORITY AND MULTIPLE OBJECTIVE PLANNING,
Tennessee Valley Authority, Norris. Div. of Water Control Planning.
For primary bibliographic entry see Field 6B.
W77-01157

THE DEPARTMENT OF TRANSPORTATION - USE OF MULTI-OBJECTIVE PLANNING,
Department of Transportation, Washington, D.C.
For primary bibliographic entry see Field 6B.
W77-01158

IMPLEMENTATION OF MULTI-OBJECTIVE PLANNING IN THE DEPARTMENT OF COMMERCE,
Department of Commerce, Washington, D.C. Office of Policy Development and Coordination.
For primary bibliographic entry see Field 6B.
W77-01159

CONCERNS OF THE U.S. FISH AND WILDLIFE SERVICE IN MULTI-OBJECTIVE PLANNING,
Bureau of Sport Fisheries and Wildlife, Washington, D.C.
For primary bibliographic entry see Field 6B.
W77-01160

THE USE OF MULTIPLE OBJECTIVE PLANNING IN THE BUREAU OF LAND MANAGEMENT,
Bureau of Land Management, Denver, Colo.
For primary bibliographic entry see Field 6B.
W77-01161

PERSPECTIVE AND ROLE OF THE ECONOMIC RESEARCH SERVICE IN MULTIPLE OBJECTIVE PLANNING,
Department of Agriculture, Lincoln, Nebr.
For primary bibliographic entry see Field 6B.
W77-01162

THE GROUND WATER LEGAL REGIME AS INSTRUMENT OF POLICY OBJECTIVES AND MANAGEMENT REQUIREMENTS,
City Univ. of New York.
R. D. Hayton.
In: Proceedings of the International Conference On Water Law and Administration, International Association for Water Law, February 8-14, 1976, Caracas, Venezuela; Published by the Commission for The National Water Resources Development Plan (Coplanarh), Caracas, Venezuela, p 272-293, 1976. 22 p.

Descriptors: *Water quality control, *Groundwater availability, *Groundwater, *Foreign countries, *Well regulations, Groundwater mining, Groundwater potential, Groundwater resources, Permits, Regulation, Water pollution, Water allocation(Policy), Water table, Water table acquifers, Water users, Water wells, Legal aspects.

Legal systems around the world have long treated ground water as a system apart, and have developed rules and regulations that do not reflect ground water's relationship with the water system of a nation as a whole. Also, each country's laws are different. For example, Islamic law prevents wells from being dug too close to one already in existence. In Spain, rights to ground water depend on the nature of the overlying land whether it is public or private; and many European countries follow the rule that ground water belongs absolutely to the owner of the overlying land, according to the principle that land ownership includes title to everthing in the subsoil. Recent trends in ground water law indicate that restrictions on the unlimited title are being imposed. For instance, the following are becoming prevalent: use limitations; quantity of extraction limitations; drilling permits;

restrictions and standards; use licenses; zones of conservation or prohibition; and reporting and registering requirements. The world's nations are now coming to the point of view that as surface water availability diminishes through pollution, greater steps must be taken to protect ground water resources. (Frank-Florida)
W77-01181

A SUBURBAN MODEL OF RATIONAL GROUND WATER UTILIZATION: A PLAN FOR NASSAU COUNTY,
City Univ. of New York.
For primary bibliographic entry see Field 4B.
W77-01182

THE INTERFACE BETWEEN PLANNING AND WATER LEGISLATION,
A. Wiener.
In: Proceedings of the International Conference on Water Law and Administration, International Association for Water Law, February 8-14, 1976, Caracas, Venezuela; Published by The Commission for the National Water Resources Development Plan (Coplanarh), Caracas, Venezuela, p 408-432, 1976. 25 p.

Descriptors: *Foreign countries, *Long-term planning, *Water conservation, *Legal aspects, *Water supply development, *Water demand, Short-term planning, Planning, Water utilization, Prior appropriation, Beneficial use, Cost-benefit theory, Cost analysis, Cost comparisons, Water resources development, Water law.

Water legislation has adhered to traditional legal doctrines that were suited to the water resources situation of hundreds of years ago. Today is an era of pollution and an ever-decreasing water supply. Although society has been served well in the past, a major effort must be made to establish new criteria which are compatible with anticipated future regulative needs of the water resource system. Large obstacles will be in the way of any legal changes, including institutional inertia, vested interests, and the lack of requisite information. For instance, prior appropriation doctrines are not likely to be easily changed when landowners have been relying on them for hundreds of years. The fact that they may not be the most efficient method of handling the water resources will not disturb those who are benefitting from the present system. The author favors a change to a broad generalize type of legislation, leaving a wide discretionary range to the proper administrative agencies. Furthermore, he warns that systems used for rich societies will not necessarily work for poor ones. (Frank-Florida)
W77-01183

WATER LAW AND NEW TECHNOLOGIES.
United Nations, New York.
In: Proceedings of the International Conference on Water Law and Administration, International Association for Water Law, February 8-14, 1976, Caracas, Venezuela; Published by The Commission For The National Water Resources Development Plan (Coplanarh), Caracas, Venezuela p 434-454, 1976. 21 p, 24 ref.

Descriptors: *Desalination, *Technology, *Water supply, *Water supply development, Water conservation, Water demand, Industries, Industrial plants, Industrial water, Water utilization, Cooling, Cooling water, Desalination processes, Surface water, Ground water, Zoning, Legal aspects, Water resources development, Water resources.

Recent technological advancements may serve to decrease water demand. For example, the use of air-cooling systems that employ closed cycles instead of consuming large quantities of freshwater will help lower demand, as will the industrial use of brackish water for cooling purposes. The improvement of wind-generation techniques and the expansion of cooling ponds, as well as the new drip irrigation, should also help curb the growing need for water. A more efficient use may be made of water. A more efficient use may be made of water through re-use techniques. Industry, which is one of the largest water users, is beginning to find second and even third uses for water within a single plant, even if such re-use require some in-house treatment. Water supply can also be increased by better desalination techniques, cloud seeding and long-distance transportation of water from high to low rainfall areas. Water law itself must better integrate surface water with ground water, as today they are treated as two distinct systems when they are really part of the same cycle. Zoning and soil management must become integrated with water management as well. Finally, the law must assess new technologies and decide which ones will be developed, restricted, blocked or fostered. (Frank-Florida)
W77-01184

LEGAL PROBLEMS ASSOCIATED WITH THE ROLE OF PLANNING IN WATER RESOURCES MANAGEMENT,
Melbourne Univ., Parkville (Australia). College of Law.
S. D. Clark.
In: Proceedings of the International Conference on Water Law and Administration, International Association for Water Law, February 8-14, 1976, Caracas, Venezuela; Published by the Commission for the National Water Resources Development Plan (Coplanarh), Caracas, Venezuela, p 460-488, 1976. 29 p, 12 ref, 1 append.

Descriptors: *Comprehensive planning, *Long-term planning, *Legal aspects, *Decision-making, *Water resources, Short-term planning, Project planning, Project benefits, Political aspects, Political constraints, Management, Administration, Programs, Projections.

Defined planning criteria and procedures are not always observed in public and private water development proposals. This failure to include desired or necessary input greatly reduces the effectiveness of the proposals. It is, therefore, the province of the law to make sure that these criteria and procedures are observed. Since legal techniques and institutions cannot guarantee wise decisions, the law must ensure that decision makers are adequately informed and give proper consideration to relevant criteria. The author contends that the ultimate decision on a proposal is properly political; he does not wish to push the law into that decision-making process. Nevertheless, the law should force the examination of all possible results. In discussing the political process, the roles of the leislature, executive and the courts are examined in connection with their difficulties in imposing planning procedures. Practical problems of drafting legislation to define planning procedures are also considered. (Frank-Florida)
W77-01185

FLORIDA'S SYSTEM FOR REGULATION OF WATER USE--A MODERN INSTRUMENT FOR SOUND WATER RESOURCE MANAGEMENT,
Florida Univ., Gainesville. Coll. of Law.
F. E. Maloney.
In: Proceedings of the International Conference on Water Law and Administration, International Association For Water Law, Feb 8-14, 1976, Caracas, Venezuela. 21 p, 2 append.

Descriptors: *Florida, *Legislation, *Administrative agencies, *Water resources development, *Water permits, *Planning, *Water utilization, Administration, Legal aspects, Water use, Groundwater utilization, Prior appropriation, Riparian rights, State governments, Water resources.
Identifiers: *Florida Water Resources Act of 1972.

Two different systems for regulating water use have developed in the United States: the riparian system in the East, and the prior appropriation system in the West. Both provide for water rights in perpetuity, as long as the use is proper. Florida has developed a more flexible system under the 1972 Florida Water Resources Act. The system is marked by its reliance on fixed term permits rather than in perpetuity permits. This gives the state the ability to re-evaluate water right priorities as time goes on, instead of being locked into an existing allocation system. The Florida law provides for a two-tiered administrative structure with overall state-level supervision plus regulatory implementation by five water management districts whose boundaries are based on hydrological considerations. Also examined are the standards and considerations that go into the issuance of consumptive use permits, as well as provisions for water shortages and emergencies. The law is noteworthy for its assumption that the public should be the primary beneficiary of water benefits and not merely private persons. Most fixed term permits will undoubtedly be renewed, but the state does have the flexibility to deal with changing water resource conditions. (Frank-Florida)
W77-01186

COOPERATIVE CONTROL OF INTERNATIONAL POLLUTION AND COMMON PROPERTY RESOURCES,
University of Western Ontario, London.
For primary bibliographic entry see Field 5G.
W77-01290

WATER AVAILABLE FOR ENERGY--UPPER COLORADO RIVER BASIN,
Utah State Engineer's Office, Salt Lake City.
For primary bibliographic entry see Field 3E.
W77-01350

SEA FARMING: A MEANS FOR CONTRIBUTING TO FEEDING MANKIND, (IN SPANISH),
Instituto de Biologia Marina, Mar del Plata (Argentina).
E. E. Boschi.
Inst Biol Mar (Mar Del Plata) Ser Contrib. 281, p 1-31, 1974.

Descriptors: Marine organisms, *Fish farming, Foods, Tilapia.
Identifiers: France, Japan, *Sea farming, Spain.

The cultivation of marine organisms for human food will never take the place of commercial fishing since only 3% of the world's ocean surface can be used for this activity. A coastal fringe of not more than 30 m depth offers the best immediate possibilities. The Food and Agriculture Organization (FAO) has estimated that 43 countries in 1972 produced, by ocean and lake farming, 3,700,000 tons of fish and 1,300,000 tons of shellfish, 7.5% of the total production for that year, or 65,000,000 tons. In countries with the greatest resources, artificial production of marine and freshwater animals has developed very slowly. Two principal orientations are meeting basic food demands by producing cheap and easy-to-grow food fishes, such as Tilapia, carp, etc., and growing species of high market value, especially shellfish, such as oysters, scallops, shrimp and lobster. The Spanish mussel industry raises 50% of the world's supply of that shellfish in pools along rivers. Similar examples are cited for France and Japan.--Copyright 1975, Biological Abstracts, Inc.
W77-01421

APPLICATION OF MUNICIPAL BY-LAWS WITH SPECIAL REFERENCE TO DRAINAGE REGULATIONS,
Johannesburg City Engineer's Dept. (South Africa).
For primary bibliographic entry see Field 4A.
W77-01485

RULES AND REGULATIONS: CONFINED FEEDING OPERATIONS.
For primary bibliographic entry see Field 5G.
W77-01512

PROCEEDINGS OF CONFERENCE ON FARM ANIMAL WASTES: 'FARMER EXPERIENCES, CODES, GUIDELINES, RESEARCH PROGRESS, EQUIPMENT'.
Wisconsin Univ.-Madison. Cooperative Extension Programs.
For primary bibliographic entry see Field 5G.
W77-01521

ENVIRONMENTAL POISONS.
For primary bibliographic entry see Field 5C.
W77-01547

6F. Nonstructural Alternatives

ENERGY AND THE COASTAL ZONE: PULLING AND HAULING AMONG THE FEDS,
For primary bibliographic entry see Field 6E.
W77-01081

FEDERAL REGULATION OF DEVELOPMENT IN FLOOD-PRONE WETLANDS--THE ARMY CORPS OF ENGINEERS,
Florida Univ., Gainesville. School of Law.
For primary bibliographic entry see Field 6E.
W77-01094

A STUDY OF VARIOUS STATE FLOOD PLAIN REGULATIONS IN AN EFFORT TO EMPHASIZE FLORIDA'S NEED TO EXACT COMPREHENSIVE PLANNING AND LAND USE CONTROLS, WHICH ARE DESIGNED TO AFFORD PROTECTION AGAINST HURRICANE DAMAGE,
Florida Univ., Gainesville. School of Law.
For primary bibliographic entry see Field 6E.
W77-01095

USE OF BUILDING CODES: TO REGULATE FLORIDA'S HURRICANE FLOOD PLAIN,
Florida Univ., Gainesville. School of Law.
For primary bibliographic entry see Field 6E.
W77-01096

DRAWING THE LINE AT THE OCEANFRONT, THE ROLE OF COASTAL CONSTRUCTION SET-BACK LINES IN REGULATING DEVELOPMENT OF FLORIDA'S COASTAL ZONE,
Florida Univ., Gainesville. School of Law.
For primary bibliographic entry see Field 6E.
W77-01097

THE NATIONAL FLOOD INSURANCE ACT OF 1968 AND FLOOD PLAIN ZONING IN ARKANSAS, NEBRASKA, NORTH DAKOTA, MISSISSIPPI, TENNESSEE, SOUTH DAKOTA, AND KANSAS,
Florida Univ., Gainesville. School of Law.
For primary bibliographic entry see Field 6E.
W77-01099

WATER MANAGEMENT AND ADMINISTRATION IN THE SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT,
Florida Univ., Gainesville. School of Law.
For primary bibliographic entry see Field 6E.
W77-01101

COASTAL CONSTRUCTION AN' OTHER PHYSICAL ACTIVITIES SEAWARL OF THE MEAN HIGH WATER LINE,
Florida Univ., Gainesville. School of Law.
For primary bibliographic entry see Field 6E.
W77-01102

DEALING WITH VARIABLE FLOOD HAZARD,
Corps of Engineers, Fort Worth, Tex.
J. A. McCrory, L. D. James, and D. E. Jones, Jr.
Journal of the Water Resources Planning and Management Division, Vol. 102, No. WR2, p 193-208, November 1976. 7 fig, 4 tab, 17 ref. Amer. Soc. of Civil Engrs. Proc.

Descriptors: *Flood control, *Flood damage, *Flood plain insurance, *Flood plains, *Regulation, Water resources, Flood frequency, Non-structural alternatives, Management, Hazards.
Identifiers: *Flood hazards.

The National Flood Insurance Program administered by the Federal Insurance Administration, HUD-FHA Minimum Property Standards, and most local flood-plain management programs define flood hazard areas as lands inundated by the 100-year flood. Curves are developed that can be used to manage flood-plain land on an equal damage exposure basis given the stage-frequency relationship for the flood plain and the stage-damage relationship for each property. The issue of acceptable damage exposure is considered through comparisons with fire insurance rates, property taxes, and rates of return on property investments. An examination of the difference between the two indices shows that the equity advantage of management on the basis of damage exposure can be balanced with the administrative advantage of regulation on a frequency basis by continuing to use frequency but varying the return period used according to the damage exposure. (Bell-Cornell)
W77-01343

A TWO-DIMENSIONAL FLOOD ROUTING MODEL,
University of the Witwatersrand, Johannesburg (South Africa). Dept. of Civil Engineering.
For primary bibliographic entry see Field 4A.
W77-01358

EVALUATION REPORT: WATER RESOURCES APPRAISAL FOR HYDROELECTRIC LICENSING. DAYTON DEVELOPMENT, PROJECT NO. 287, FOX RIVER, WISCONSIN AND ILLINOIS.
Federal Power Commission, Washington, D.C. Bureau of Power.
May 1976, 42 p, 15 fig, 6 tab.

Descriptors: *Hydroelectric power, *Hydroelectric plants, *Permits, *Illinois, Federal Power Act, Dam failure, *Water resources development, Ice jams.
Identifiers: Licenses, *Fox River(IL), North Counties Hydro-electric Company, Illinois River Basin.

The Dayton hydroelectric project is located on the Fox River, Illinois, 70 mi southwest of Chicago. This report included descriptions of the Fox River Basin, prior reports and current investigations, the economy of the Basin, existing and related water resources developments, a history of the Dayton project (dating to 1920), and future development and utilization. The original license for the project was granted in 1924, to extend for 50 years. Currently North Counties Hydro-Electric Company is the sole licensee (now on annual license). The Illinois Power Company purchases the entire output of the plant. Three times the project operation has been shut down by ice jams in the tailwater area which resulted in claims against the United States for damages allegedly caused by the Corps of Engineers' Starved Rock Dam on the Illinois River. There have been only minor repairs made over the years and recent surveys have indicated that the project is in poor condition and is potentially dangerous. A major buttress footing has been undercut along with other buttresses and wingwalls. However, in the event of sudden dam failure, little damage is anticipated because of the undeveloped nature of areas below the dam and small volume of water behind the dam. Redevelopment of the site is considered unwarranted and repairs on the structure are estimated at $160,000. Thus future operation of the Dayton project appears to be financially questionable. This report does not come to conclusions about the disposition of the Dayton project, but provides information for the Federal Power Commission and its staff to consider that disposition. (Smith-North Carolina)
W77-01511

6G. Ecologic Impact Of Water Development

A TECHNIQUE FOR PREDICTING THE AQUATIC ECOSYSTEM RESPONSE TO WEATHER MODIFICATION,
Utah Center for Water Resources Research, Logan.
For primary bibliographic entry see Field 3B.
W77-01051

RESEARCH TO DEVELOP ECOLOGICAL STANDARDS FOR WATER RESOURCES,
Oklahoma Univ., Norman. Bureau of Water and Environmental Resources Research.
George W. Reid.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-260 488, Price codes: A14 in paper copy, A01 in microfiche. Completion Report, July 1976. 304 p, 35 fig, 60 tab, 115 ref, 6 append. OWRT B-032-OKLA(1). 14-31-0001-5132.

Descriptors: *Planning, *Water resources development, *Evaluation, *Standards, Ecology, *Ecosystems, *Environment, Social impact, *Oklahoma, Methodology, River basin development, Biota.
Identifiers: *Mid-Arkansas River Basin(Okla), *Ecological standards.

This study attempts to develop ecological standards to assist in the evaluation of water resources development. The standards developed are meaningful for and applicable to all the aquatic, land and land-water interface environments. Two steps were undertaken to establish ecological standards. The first one is the categorization of development levels of natural environment by measuring specific socio-economic factors which are capable of delineating the human modification of the ecological system. The second one is the development of the ecological standards in response to various development levels so as to reflect the human influence on the ecological system. A unique and significant feature of the project is the combination of both socio-economic and environmental considerations in the evaluation of the ecological system. The validation of the methodology is accomplished by using data from the Mid-Arkansas River Basin.
W77-01054

RECENT DEVELOPMENTS IN THE LAW OF THE SEA: A SYNOPSIS,
For primary bibliographic entry see Field 6E.
W77-01075

JARVIS V STATE LAND DEPARTMENT (USE OF WATER OUT OF CRITICAL GROUNDWATER IN AMOUNT EQUAL TO ANNUAL HISTORICAL MAXIMUM USE).
550 P2d 227-30 (Ariz 1976). 4 p.

Descriptors: *Arizona, *Water supply development, *Water shortage, *Water policy, *Water importing, Water delivery, Water conveyance, Legal

review, Judicial decisions, Water demand, Water management(Applied), Water distribution(Applied), Water conservation, Pumping, Wells.
Identifiers: *Injunctive relief.

Plaintiff city sought modification of a permanent injunction which had been obtained by the defendant on behalf of himself and others who cultivated land in a critical water area. The injunction prohibited the city from pumping water out of the critical water area for transport and use in the city. On review the enjoining court held that if the city purchased land within the critical water area it could use the water formerly used for growi ng crops thereon. This the city had done; now it sought to modify the injunction to allow pumping to begin. The defendant contended that the injunction did not allow the city to pump out the greatest amount of water used in any year on the parcel purchased, but only to pump out an average of the annual maximum amount of water used on the parcel retired from utilization. The Arizona Supreme Court accepted defendant's argument and interpreted the injunction's use of the word 'historical' as requiring the word 'maximum' to be restricted to an average of the annual maximum amount of water previously used on the parcel purchased. (Welch-Florida)
W77-01111

EVALUATING ENVIRONMENTAL QUALITY MANAGEMENT PROGRAMMES IN WHICH DISCHARGERS ARE GROUPED,
Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5G.
W77-01170

ECOSYSTEM MODELS AND ENVIRONMENTAL POLICY,
San Diego State Univ., Calif. Center for Regional Environmental Studies.
C. F. Cooper.
Simulation, Vol. 26, No. 5, p 133-138, May 1976. 11 ref.

Descriptors: *Ecosystems, *Environment, *Mathematical models, Simulation analysis, Decision making, Management, Planning, Systems analysis, Model studies.
Identifiers: *Environmental quality.

The use of models for guiding environmental policy should be distinguished from their use in implementing management policies already decided upon. Ecosystem models are of potentially great value for guiding and informing incremental decisions regarding environmental policy. They are unlikely to be used as a basis for comprehensive restructuring of programs. Their greatest use may lie in identifying points of leverage, where incremental policy changes will have the greatest long-term beneficial impact. For this reason, provision for formal sensitivity analysis is essential in models used to guide environmental policy. Ecological models are more likely to influence policy decisions if they incorporate features which should be a part of any good model but which are often skimped-upon: adequate documentation; reasonableness of prediction; explanation of limits and probable range of error; flexibility to deal with unanticipated problems; and effective presentation and display. (Bell-Cornell)
W77-01172

THE SAINT JOHN RIVER SYSTEM MODELS: A CASE STUDY,
Department of the Environment, Ottawa (Ontario). Ecological Systems Research Div.
For primary bibliographic entry see Field 5G.
W77-01178

DRAFT ENVIRONMENTAL STATEMENT: PROJECT SKYWATER A PROGRAM OF RESEARCH IN PRECIPITATION MANAGEMENT, VOLUME I OF II.
Bureau of Reclamation, Washington, D.C.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-251 113, Price codes: A14 in paper copy, A01 in microfiche. 1976. 220 p, 36 fig, 37 tab.

Descriptors: *Environmental effects, *Cloud seeding, *Weather modification, *Water resources development, Artificial precipitation, Weather, Water management(Applied), Water resources, Technology, Research and development, Rocky Mountain region, Pacific Coast region, Agriculture, Silver iodide, On-site investigations, Erosion, Avalanches, Snowpacks, Federal government, Snow, Water yield improvement.
Identifiers: *EIS, *Project Skywater.

The Department of the Interior has filed a draft environmental statement on its research effort in developing the technology of cloud seeding. The Department hopes that cloud seeding will be come a useful water resources management tool. Most of the studies have been conducted in the Western states, an area which includes a subtropical climate along the Pacific Coast, a vast, arid region in New Mexico and Arizona and the high, weather-making Rocky Mountains. The environmental impact of the project is expected to be minimal with only insignificant increases in plant growth and streamflow. With development of a successful technology, significant increases in plant growth and streamflow would be expected. Other than a probable increase in the incidence of avalanches, no significant adverse impacts have been identified. Project alternatives include such methods of increasing water resources as desalinization, exploitation of groundwater resources, recycling of water, and land management for increased water yield. Resources consumed by the project include cloud seeding chemicals, airplane fuel, and electrical energy. (Capehart-Florida)
W77-01187

ARE HOVERCRAFT A MAJOR CAUSE OF DISTURBANCES TO INERTIDAL INVERTEBRATES,
Institute of Terrestrial Ecology, Norwich (England). Colney Research Station.
S. A. McGorty, Jenyon, and R. Le B. Williams.
Biological Conservation, Vol. 9, No. 7, p. 13-20, 1976, 3 fig., 3 tab., 3 ref.

Descriptors: *Environmental effects, *Invertebrates, *Habitats, *Intertidal areas, *Sands, *Particle size, *Food chains, Populations, Analytical techniques, On-Site Data Collections.
Identifiers: *Hovercraft, Nereis spp., Arenicola spp., Spionid spp.

The densities of intertidal invertebrates in areas within and outside a hovercraft flightpath were compared by analysis of variance and least significant range tests. No evidence was found to suggest that the hovercraft had significantly reduced the density of invertebrates in the flightpath area. Only five species groups (Nereis diversicolor, Spionid spp., Bathyporeia spp., Macoma balthica, and Arenicola marina) had significantly different densities between areas, and in each case there was a density gradient alongshore. In three species groups (Spionid spp., Bathyporeia, spp., and Macoma balthica) density was related to the percentage of fine sand at each site. (Katz)
W77-01263

COOPERATIVE CONTROL OF INTERNATIONAL POLLUTION AND COMMON PROPERTY RESOURCES,
University of Western Ontario, London.
For primary bibliographic entry see Field 5G.
W77-01290

ENVIRONMENTAL DATA MANAGEMENT,
G. K. Young, and G. F. Tierney.
Journal of the Water Resources Planning and Management Division, Vol. 102, No. WR2, Proceedings of the American Society of Civil Engineers, p 255-264, November 1976. 5 fig.

Descriptors: *Computer models, *Data processing, *Statistical methods, Water quality, Environmental engineering, Standards, Forecasting, Systems analysis, Simulation analysis.
Identifiers: *Environmental quality, *Information systems, *Data management, Error, Cost distribution, Protocol, Data.

A holistic viewpoint is taken of basic data needs to support environmental forecasting, modeling, and decision making. A protocol is suggested which places forecast errors in a key role. Data bases should be reviewed and their error properties analyzed with respect to forecasting precision. Data programs should be oriented to minimizing forecast variance within cost and overall program needs constraints. Recognized big issues concern the: (1) Need for a rational data assessment protocal; (2) difficulty of generalizing requirements; (3) fact that simulation models have outdistanced the availability of data to support them; (4) observation that agency programs apparently place too much stress on analysis and not enough on data gathering activities; and (5) chronic problem that water quatity and quality data collection needs to be coordinated. (Bell-Cornell)
W77-01347

POLLUTION, MAN, HIS ENVIRONMENT AND THE PHYSICIST, (BESOEDELING, DIE MENS, SY OMGEWING EN DIE FISIKUS),
For primary bibliographic entry see Field 5G.
W77-01482

ARTIFICIAL ISLANDS: INFORMATION NEEDS AND IMPACT CRITERIA,
Delaware Univ., Lewes. Marine Studies Center.
L. Watling.
Marine Pollution Bulletin, Vol. 6, No. 9, p. 139-141, September, 1975. 3 ref.

Descriptors: *Environmental effects, *Reviews, Water quality, Structures, *Salinity, *Temperature, *Turbidity, Technology, *Light penetration, *Water pollution effects, Water quality control, Marine animals, Benthos, Sediments.
Identifiers: *Artificial Islands, *Environmental impact.

This is a review of the information needed before realistic forecasts can be made of the effects of new developments on the marine environment. The review resulted from the need to assess the impact of an artifical island off the east coast of the United States. Manmade structures in the sea, ranging from oil platforms to large anchored floating structures and reclaimed land in shallower water, are proliferating around the world with more forseen in the future. It will be important to forecast the effect they have on the surrounding sea areas and marine resources as accurately as possible. (Katz)
W77-01501

ENVIRONMENTAL POISONS.
For primary bibliographic entry see Field 5C.
W77-01547

7. RESOURCES DATA

7B. Data Acquisition

THE MEASUREMENT OF WATER LOSSES FROM A FORESTED AREA USING A 'NATURAL' LYSIMETER,
Institute of Hydrology, Wallingford (England).

For primary bibliographic entry see Field 2D.
W77-01148

IFYGL RAWINSONDE DATA ACQUISITION SYSTEM,
National Oceanic and Atmospheric Administration, Ann Arbor, Mich. Great Lakes Environmental Research Lab.
For primary bibliographic entry see Field 2H.
W77-01189

METHOD FOR FINDING TEMPERATURE ENVIRONMENTS FOR FISH,
G. Peterson.
U. S. Patent No. 3,968,586, 10 p, 8 fig, 1 tab, 6 ref; Official Gazette of the United States Patent Office, Vol 948, No 2, p 440, July 13, 1976.

Descriptors: *Patents, *Water measurement, *Temperature, *Thermocline, *Environmental gradient, Depth, Fish, Fish populations, Fishing, Environments, Habitats, Instrumentation.

This invention relates to a method of prospecting for fish in lakes and oceans, and more particularly to water differential temperature measurement for use in conjunction with boats for the express purpose of locating suitable or likely environments for specific varieties of fish. Since fish have preferred temperatures, they will seek these temperatures in lakes and oceans if they can be found and will usually stay in those regions where the preferred temperatures prevail. Fishing boats are equipped with an apparatus whereby temperature measurements can be taken at, or near the surface of a large body of water. The apparatus is comprised of a highly sensitive differential temperature measuring means such as a pair of thermistor-type probes which are connected to opposite arms of a highly sensitive wheatstone bridge curcuit. On the the thermistors is easily interchangeable with a variable standard resistor thereby providing the capability of taking direct temperature measurements. The method consists of locating the specific varieties of fish by making a series of passes with the boat, making differential temperature measurements just beneath the surface of the water, plotting differential temperature measurements on the chart and comparing the chart with known temperature environments suitable for certain types of fish. (Sinha-OEIS)
W77-01212

OCEANOGRAPHIC APPARATUS,
General Dynamics Corp., St. Louis, Mo. (Assignee).
For primary bibliographic entry see Field 2L.
W77-01214

IN-SITU OCEANOGRAPHIC SAMPLE SEPARATOR,
Office of the Secretary (Navy), Washington, D.C.
For primary bibliographic entry see Field 2L.
W77-01223

DYNAMICALLY BALANCED APPARATUS FOR WATER BORNE INSTRUMENTS,
S. J. Niskin.
U.S. Patent No. 3,971,251, 9 p, 9 fig, 2 ref; Official Gazette of the United States Patent Office, Vol 948, No 4, p 1353, July 27, 1976.

Descriptors: *Patents, *Instrumentation, *Water measurement, *Currents(Water), *Flow measurement, Current meters, Waves(Water).
Identifiers: Instrument housing.

When measuring the flow of water for direction and velocity instruments must be maintained in a horizontal position and facing the direction of flow of water. However, in the event the current is very fast or the water becomes rough with high and violent wave actions, the float and cable to which the instruments are attached will cause the latter to rise and fall and oscillate or vibrate out of their proper position so that inaccurate results are obtained. This invention provides water borne instruments with a housing that is dynamically balanced whereby the instruments are maintained in the current of the body of water in a predetermined and optimum position for the operation of the instruments. The housing is supported by a cable anchored at one end and having a float at the other end, the housing being pivotally suspended from a stand-off which is rotatably secured to the cable to prevent entanglement of the housing with the cable. The housing is supported at its mid-portion with arms extending horizontally. The meters are mounted on each of the arm portions facing in the direction from which the water flows. The housing maintains this position with rudders or vanes which have a dampening effect on forces attempting to swing the housing out of alignment with the current flow. (Sinha-OEIS)
W77-01232

THE INTERPRETATION OF RAINFALL PATTERNS IN NORTHERN YUCATAN UTILIZING METEOROLOGICAL SATELLITE IMAGERY,
University of South Alabama, Mobile.
For primary bibliographic entry see Field 2B.
W77-01280

MEASURING HYDROLOGIC PROPERTIES OF SOIL WITH A DOUBLE-RING INFILTROMETER AND MULTIPLE-DEPTH TENSIOMETERS,
Hawaii Univ., Honolulu. Dept. of Agronomy and Soil Science.
For primary bibliographic entry see Field 2G.
W77-01325

EVAPORATION MEASUREMENTS WITH A SELF-RECORDING EVAPORIGRAPH,
Meteorological Office, Poona (India).
For primary bibliographic entry see Field 2D.
W77-01331

AN EVAPORATION EQUATION FOR AN OPEN BODY OF WATER EXPOSED TO THE ATMOSPHERE,
Auburn Univ., Ala. Dept. of Mechanical Engineering.
For primary bibliographic entry see Field 2D.
W77-01338

LEAF DIFFUSION RESISTANCE TO WATER VAPOUR AND ITS DIRECT MEASUREMENT,
Agricultural Univ., Wageningen (Netherlands). Lab. of Physiological Meteorology.
For primary bibliographic entry see Field 2D.
W77-01378

A RECORDING SOIL MOISTURE TENSIOMETER,
Forest Service (USDA), Portland, Oreg. Pacific Northwest Forest and Range Experiment Station.
For primary bibliographic entry see Field 2G.
W77-01429

SNOWMELT LYSIMETERS PERFORM WELL IN COLD TEMPERATURES IN CENTRAL COLORADO,
Forest Service (USDA), Fort Collins, Colo. Rocky Mountain Forest and Range Experiment Station.
For primary bibliographic entry see Field 2C.
W77-01432

PROSPECTS OF HYDROMETRY IN THE LIGHT OF MODERN TECHNOLOGY,
International Commission on Irrigation and Drainage, New Delhi (India).
K. K. Framji.
International Commission on Irrigation and Drainage Bulletin, p 20-28, January 1975. 44 ref.

Descriptors: *Hydrometry, *Measurement, Technology, Water quality, Water quality control, Water measurement, Irrigation, Instrumentation.

The prospects from the use of modern technology that is, the application of modern sciences and the use of modern tools and materials are clearly bright for the development of precise methods and instruments of hydrometry. Sciences and technologies, such as computer-science electronics, ultrasonic and telemetry, the use of lightweight plastics and special non-ferrous alloys, the application of specially-designed hydrometric ships and aluminium and fiberglass boats, all point to future prospects of achieving high degrees of precision and uniformity in measurements. Also in the not too distant future the use of space craft and earth satellites for automatic transmission of automatically observed data is no longer in the realm of fantasy. The sky is the limit. (Skogerboe-Colo St)
W77-01519

DESIGN AND PRELIMINARY EVALUATION OF AN IMPROVED ARTIFICIAL SUBSTRATE SAMPLER FOR AQUATIC MACROINVERTEBRATES,
Texas Instruments, Inc., Northfield, Mass. Ecology Service Group.
M. D. McDaniel.
Prog Fish-Cult. 36(1), p 23-25, 1974.

Descriptors: *Invertebrates, Sampling, Benthos, *Analytical techniques, Monitoring, Design.

A number of artificial substrate devices have been developed to circumvent obstacles encountered in conventional benthic sampling for macroinvertebrates. These devices, at best, are only semi-quantitative, yet they provide freedom in selection of sampling site and homogeneity of substrate type and area. Their use can result in samples with good potential for comparisons within and among various aquatic ecosystems. An improved artificial substrate sampler has been developed that combines the features of a multiple-plate sampler with a synthetic webbing material. The new sampler is inexpensive, easily portable; and may be processed in the field and returned to the water or returned to the lab for processing. It is an effective sampling method in both lotic and lentic environments and that is possesses great potential for biological water quality monitoring.--Copyright 1975, Biological Abstracts, Inc.
W77-01530

7C. Evaluation, Processing and Publication

A REVISED REGIONAL FREQUENCY CURVE FOR THE YARRA CATCHMENT ABOVE WARRANDYTE (AUSTRALIA).
Melbourne and Metropolitan Board of Works (Australia), Water supply, Sewerage and Drainage Branch.
For primary bibliographic entry see Field 4A.
W77-01068

FUTURE DIRECTION OF URBAN WATER MODELS,
Water Resources Engineers, Inc. Walnut Creek, Calif.
For primary bibliographic entry see Field 5G.
W77-01071

COMPRESSION OF TIME-SERIES DATA,
Ministry of Works, Wellington (New Zealand). Water and Soil Div.
R. P. Ibbitt.
Journal of Hydrology (New Zealand), Vol. 14, No. 1, p 30-41, 1975. 2 fig, 4 tab, 2 ref, 2 append.

Descriptors: *Data processing, *Water levels, *Data storage and retrieval, *Computers, Regression analysis, Rating curves, Streamflow, Stream gages, Analytical techniques, Information retrieval, Equations.
Identifiers: *Data compression, Interpolating, Time-series data.

When water level data are stored on a computer, the amount of storage space needed can be reduced by eliminating data that can be provided approximately by linear interpolation. Benefits from reduced computer time are also obtained since fewer values have to be retrieved from the file. The aim of the compression process is to filter out small and abrupt water level fluctuations without affecting the information content of the record. To avoid over-compressing the data, it is desirable to have some method by which an upper limit on the 'compression range' can be determined. A method was presented by which this limit can be obtained under different assumptions about the accuracy of a rating curve. (Sims-ISWS)
W77-01132

MATHEMATICAL ANALYSIS OF THE CHEMICAL SYSTEM 'CYANIDE-HEAVY METALS' IN WATER-DETERMINATION OF COMPONENTS AND TOXICITY OF THE SYSTEM-II, SOLUTION BY COMPUTER,
State Textile Research Inst., Brno (Czechoslovakia). Center for Research and Application Ionized Radiation.
For primary bibliographic entry see Field 5B.
W77-01260

RESOURCE INVENTORY MANAGEMENT PLANNING SYSTEM (RIMPS). USER MANUAL,
Jordan (Edward C.), Inc., Portland, Maine.
For primary bibliographic entry see Field 5G.
W77-01294

A SIMPLE COMPUTER PROGRAM FOR THE DETERMINATION OF AQUIFER CHARACTERISTICS FROM PUMP TEST DATA,
Southwest Florida Water Management District, Brooksville.
J. C. Holzschuh, III.
Ground Water, Vol. 14, No. 5, p 283-285, September-October 1976. 3 fig, 1 tab, 2 ref.

Descriptors: *Computer programs, *Data processing, *Aquifer characteristics, *Pump testing, Estimating, Analytical techniques, Graphical methods, Graphical analysis, Leakage, Transmissivity, Storage coefficient, Hydraulic conductivity.
Identifiers: *Hantush inflection point method, Desk calculators, Turnaround time, Leakance.

A computer program, based on the Hantush inflection method and designed for 'desk top' computers was presented. The method assumed a leaky, isotropic, homogeneous aquifer of infinite areal extent. The language employed was BASIC, and interactive language used on the Wang Model 2200 programmable calculator. The program can be easily adapted to FORTRAN IV for use on larger machines. (Visocky-ISWS)
W77-01337

ENVIRONMENTAL DATA MANAGEMENT,
For primary bibliographic entry see Field 6G.
W77-01347

TETON DAM FLOOD OF JUNE 1976, MORELAND QUADRANGLE, IDAHO,
Geological Survey, Boise, Idaho.
L. L. Hubbard, and J. H. Bartells.
Available from Branch of Distribution, USGS, 1200 S. Eads St., Arlington, Va. 22202, price $1.75. Hydrologic Investigations Atlas HA-580, 1976. 1 sheet, 1 map.

Descriptors: *Dam failure, *Floods, *Idaho, *Flood profiles, *Maps, Runoff, Water levels, Elevation, High water mark, Contours, Aerial photography.
Identifiers: *Teton Dam(Idaho), *Snake River, Inundated area.

The failure of the Teton Dam caused extreme flooding along the Teton River, Henrys Fork, and Snake River in southeastern Idaho on June 5-8, 1976. No flooding occurred downstream from American Falls Reservoir. The inundated areas and maximum water-surface elevations are shown in a series of 17 hydrologic atlases. The aea covered by the atlases extends from Teton Dam downstream to American Falls Reservoir, a distance of 100 miles. The extent of flooding shown on the maps was obtained by field inspections and aerial photographs made during and immediately after the flood. There may be small isolated areas within the boundaries shown that were not flooded, but the identification of these sites was beyond the scope of the study. The elevation data shown are mean-sea-level elevations of high-water marks identified in the field. This particular map (in the 17-map series) shows conditions in the Moreland quadrangle. (Woodard-USGS)
W77-01395

TETON DAM FLOOD OF JUNE 1976, FIRTH QUADRANGLE, IDAHO,
Geological Survey, Boise, Idaho.
L. L. Hubbard, and J. H. Bartells.
Available from Branch of Distribution, USGS, 1200 S. Eads St., Arlington, Va. 22202, price $1.75. Hydrologic Investigations Atlas HA-577, 1976. 1 sheet, 1 map.

Descriptors: *Dam failure, *Floods, *Idaho, *Flood profiles, *Maps, Runoff, Water levels, Elevation, High water mark, Contours, Aerial photography.
Identifiers: *Teton Dam(Idaho), *Snake River, Inundated area.

The failure of the Teton Dam caused extreme flooding along the Teton River, Henrys Fork, and Snake River in southeastern Idaho on June 5-8, 1976. No flooding occurred downstream from American Falls Reservoir. The inundated areas and maximum water-surface elevations are shown in a series of 17 hydrologic atlases. The area covered by the atlases extends from Teton Dam downstream to American Falls Reservoir, a distance of 100 miles. The extent of flooding shown on the maps was obtained by field inspections and aerial photographs made during and immediately after the flood. There may be small isolated areas within the boundaries shown that were not flooded, but the identification of these sites was beyond the scope of the study. The elevation data shown are mean-sea-level elevations of high-water marks identified in the field. This particular map (in the 17-map series) shows conditions in the Firth quadrangle. (Woodard-USGS)
W77-01396

TETON DAM FLOOD OF JUNE 1976, ROSE QUADRANGLE, IDAHO,
Geological Survey, Boise, Idaho.
J. H. Bartells, and L. L. Hubbard.
Available from Branch of Distribution, USGS, 1200 S. Eads St., Arlington, Va. 22202, price $1.75. Hydrologic Investigations Atlas HA-578, 1976. 1 sheet, 1 map.

Descriptors: *Dam failure, *Floods, *Idaho, *Flood profiles, *Maps, Runoff, Water levels, Elevation, High water mark, Contours, Aerial photography.
Identifiers: *Teton Dam(Idaho), *Snake River, Inundated area.

The failure of the Teton Dam caused extreme flooding along the Teton River, Henrys Fork, and Snake River in southeastern Idaho on June 5-8, 1976. No flooding occurred downstream from American Falls Reservoir. The inundated areas and maximum water-surface elevations are shown in a series of 17 hydrologic atlases. The area covered by the atlases extends from Teton Dam downstream to American Falls Reservoir, a distance of 100 miles. The extent of flooding shown on the maps was obtained by field inspections and aerial photographs made during and immediately after the flood. There may be small isolated areas within the boundaries shown that were not flooded, but the identification of these sites was beyond the scope of the study. The elevation data shown are mean-sea-level elevations of high-water marks identified in the field. This particular map (in the 17-map series) shows conditions in the Rose quadrangle. (Woodard-USGS)
W77-01397

TETON DAM FLOOD OF JUNE 1976, MENAN BUTTES QUADRANGLE, IDAHO,
Geological Survey, Boise, Idaho.
C. A. Thomas, H. A. Ray, and W. A. Harenberg.
Available from Branch of Distribution, USGS, 1200 S. Eads St., Arlington, Va. 22202, price $1.75. Hydrologic Investigations Atlas HA-570, 1976. 1 sheet, 1 map.

Descriptors: *Dam failure, *Floods, *Idaho, *Flood profiles, *Maps, Runoff, Water levels, Elevation, High water mark, Contours, Aerial photography.
Identifiers: *Teton Dam(Idaho), *Snake River, Inundated area.

The failure of the Teton Dam caused extreme flooding along the Teton River, Henrys Fork, and Snake River in southeastern Idaho on June 5-8, 1976. No flooding occurred downstream from American Falls Reservoir. The inundated areas and maximum water-surface elevations are shown in a series of 17 hydrologic atlases. The area covered by the atlases extends from Teton Dam downstream to American Falls Reservoir, a distance of 100 miles. The extent of flooding shown on the maps was obtained by field inspections and aerial photographs made during and immediately after the flood. There may be small isolated areas within the boundaries shown that were not flooded, but the identification of these sites was beyond the scope of the study. The elevation data shown are mean-sea-level elevations of high-water marks identified in the field. This particular map (in the 17-map series) shows conditions in the Menan Buttes quadrangle. (Woodard-USGS)
W77-01398

TETON DAM FLOOD OF JUNE 1976, NEWDALE QUADRANGLE, IDAHO,
Geological Survey, Boise, Idaho.
H. A. Ray, H. F. Matthai, and C. A. Thomas.
Available from Branch of Distribution, USGS, 1200 S. Eads St., Arlington, Va. 22202, price $1.75. Hydrologic Investigations Atlas HA-565, 1976. 1 sheet, 1 map.

Descriptors: *Dam failure, *Floods, *Idaho, *Flood profiles, *Maps, Runoff, Water levels, Elevation, High water mark, Contours, Aerial photography.
Identifiers: *Teton Dam(Idaho), *Snake River, Inundated area.

The failure of the Teton Dam caused extreme flooding along the Teton River, Henrys Fork, and Snake River in southeastern Idaho on June 5-8, 1976. No flooding occurred downstream from American Falls Reservoir. The inundated areas and maximum water-surface elevations are shown in a series of 17 hydrologic atlases. The area covered by the atlases extends from Teton Dam downstream to American Falls Reservoir, a distance of 100 miles. The extent of flooding shown on the maps was obtained by field inspections and aerial photographs made during and immediately after the flood. There may be small iso-

lated areas within the boundaries shown that were not flooded, but the identification of these sites was beyond the scope of the study. The elevation data shown are mean-sea-level elevations of high-water marks identified in the field. This particular map (in the 17-map series) shows conditions in the Newdale quadrangle. (Woodard-USGS)
W77-01399

TETON DAM FLOOD OF JUNE 1976, PARKER QUADRANGLE, IDAHO,
Geological Survey, Boise, Idaho.
C. A. Thomas, and H. A. Ray.
Available from Branch of Distribution, USGS, 1200 Eads St., Arlington, Va 22202, price $1.75. Hydrologic Investigations Atlas HA-567, 1976. 1 sheet, 1 map.

Descriptors: *Dam failure, *Floods, *Idaho, *Flood profiles, *Maps, Runoff, Water levels, Elevation, High water mark, Contours, Aerial photography.
Identifiers: *Teton Dam(Idaho), *Snake River, Inundated area.

The failure of Teton Dam caused extreme flooding along the Teton River, Henrys Fork, and Snake River in southeastern Idaho on June 5-8, 1976. No flooding occurred downstream from American Falls, Reservoir. The inundated areas and maximum water-surface elevations are shown in a series of 17 hydrologic atlases. The area covered by the atlases extends from Teton Dam downstream to American Falls Reservoir, a distance of 100 miles. The extent of flooding shown on the maps was obtained by field inspections and aerial photographs made during and immediately after the flood. There may be small isolated areas within the boundaries shown that were not flooded, but the identification of these sites was beyond the scope of the study. The elevation data shown are mean-sea-level elevations of high-water marks identified in the field. This particular map (in the 17-map series) shows conditions in the Parker quadrangle. (Woodard-USGS)
W77-01400

TETON DAM FLOOD OF JUNE 1976, BLACKFOOT QUADRANGLE, IDAHO,
Geological Survey, Boise, Idaho.
J. H. Bartells, and L. L. Hubbard.
Available from Branch of Distribution, USGS, 1200 S. Eads St., Arlington, Va. 22202, price $1.75. Hydrologic Investigations Atlas HA-579, 1976. 1 sheet, 1 map.

Descriptors: *Dam failure, *Floods, *Idaho, *Flood profiles, *Maps, Runoff, Water levels, Elevation, High water mark, Contours, Aerial photography.
Identifiers: *Teton Dam(Idaho), *Snake River, Inundated area.

The failure of the Teton Dam caused extreme flooding along the Teton River, Henrys Fork, and Snake River in southeastern Idaho on June 5-8, 1976. No flooding occurred downstream from American Falls Reservoir. The inundated areas and maximum water-surface elevations are shown in a series of 17 hydrologic atlases. The area covered by the atlases extends from Teton Dam downstream to American Falls Reservoir, a distance of 100 miles. The extent of flooding shown on the maps was obtained by field inspections and aerial photographs made during and immediately after the flood. There may be small isolated areas within the boundaries shown that were not flooded, but the identification of these sites was beyond the scope of the study. The elevation data shown are mean-sea-level elevations of high-water marks identified in the field. This particular map (in the 17-map series) shows conditions in the Blackfoot quadrangle. (Woodard-USGS)
W77-01401

TETON DAM FLOOD OF JUNE 1976, PINGREE QUADRANGLE, IDAHO,
Geological Survey, Boise, Idaho.
L. L. Hubbard, and J. H. Bartells.
Available from Branch of Distribution, USGS, 1200 S. Eads St., Arlington, Va. 22202, price $1.75. Hydrologic Investigations Atlas HA-581, 1976. 1 sheet, 1 map.

Descriptors: *Dam failure, *Floods, *Idaho, *Flood profiles, *Maps, Runoff, Water levels, Elevation, High water mark, Contours, Aerial photography.
Identifiers: *Teton Dam(Idaho), *Snake River, Inundated area.

The failure of the Teton Dam caused extreme flooding along the Teton River, Henrys Fork, and Snake River in southeastern Idaho on June 5-8, 1976. No flooding occurred downstream from American Falls Reservoir. The inundated areas and maximum water-surface elevations are shown in a series of 17 hydrologic atlases. The area covered by the atlases extends from Teton Dam downstream to American Falls Reservoir, a distance of 100 miles. The extent of flooding shown on the maps was obtained by field inspections and aerial photographs made during and immediately after the flood. There may be small isolated areas within the boundaries shown that were not flooded, but the identification of these sites was beyond the scope of the study. The elevation data shown are mean-sea-level elevations of high-water marks identified in the field. This particular map (in the 17-map series) shows conditions in the Pingree quadrangle. (Woodard-USGS)
W77-01402

TETON DAM FLOOD OF JUNE 1976, MOODY QUADRANGLE, IDAHO,
Geological Survey, Boise, Idaho.
W. A. Harenberg, and B. B. Bigelow.
Available from Branch of Distribution, USGS, 1200 S. Eads St., Arlington, Va. 22202, price $1.75. Hydrologic Investigations Atlas HA-568, 1976. 1 sheet, 1 map.

Descriptors: *Dam failure, *Floods, *Idaho, *Flood profiles, *Maps, Runoff, Water levels, Elevation, High water mark, Contours, Aerial photography.
Identifiers: *Teton Dam(Idaho), *Snake River, Inundated area.

The failure of the Teton Dam caused extreme flooding along the Teton River, Henrys Fork, and Snake River in southeastern Idaho on June 5-8, 1976. No flooding occurred downstream from American Falls Reservoir. The inundated areas and maximum water-surface elevations are shown in a series of 17 hydrologic atlases. The area covered by the atlases extends from Teton Dam downstream to American Falls Reservoir, a distance of 100 miles. The extent of flooding shown on the maps was obtained by field inspections and aerial photographs made during and immediately after the flood. There may be small isolated areas within the boundaries shown that were not flooded, but the identification of these sites was beyond the scope of the study. The elevation data shown are mean-sea-level elevations of high-water marks identified in the field. This particular map (in the 17-map series) shows conditions in the Moody quadrangle. (Woodard-USGS)
W77-01403

TETON DAM FLOOD OF JUNE 1976, REXBURG QUADRANGLE, IDAHO,
Geological Survey, Boise, Idaho.
W. A. Harenberg, and B. B. Bigelow.
Available from Branch of Distribution, USGS, 1200 S. Eads St., Arlington, Va. 22202, price $1.75. Hydrologic Investigations Atlas HA-569, 1976. 1 sheet, 1 map.

Descriptors: *Dam failure, *Floods, *Idaho, *Flood profiles, *Maps, Runoff, Water levels, Elevation, High water mark, Contours, Aerial photography.
Identifiers: *Teton Dam(Idaho), *Snake River, Inundated area.

The failure of the Teton Dam caused extreme flooding along the Teton River, Henrys Fork, and Snake River in southeastern Idaho on June 5-8, 1976. No flooding occurred downstream from American Falls Reservoir. The inundated areas and maximum water-surface elevations are shown in a series of 17 hydrologic atlases. The area covered by the atlases extends from Teton Dam downstream to American Falls Reservoir, a distance of 100 miles. The extent of flooding shown on the maps was obtained by field inspections and aerial photographs made during and immediately after the flood. There may be small isolated areas within the boundaries shown that were not flooded, but the identification of these sites was beyond the scope of the study. The elevation data shown are mean-sea-level elevations of high-water marks identified in the field. This particular map (in the 17-map series) shows conditions in the Rexburg quadrangle. (Woodard-USGS)
W77-01404

TETON DAM FLOOD OF JUNE 1976, RIGBY QUADRANGLE, IDAHO,
Geological Survey, Boise, Idaho.
H. A. Ray, and B. B. Bigelow.
Available from Branch of Distribution, USGS, 1200 S. Eads St., Arlington, Va. 22202, price $1.75. Hydrologic Investigations Atlas HA-572, 1976. 1 sheet, 1 map.

Descriptors: *Dam failure, *Floods, *Idaho, *Flood profiles, *Maps, Runoff, Water levels, Elevation, High water marks, Contours, Aerial photography.
Identifiers: *Teton Dam(Idaho), *Snake River, Inundated area.

The failure of the Teton Dam caused extreme flooding along the Teton River, Henrys Fork, and Snake River in southeastern Idaho on June 5-8, 1976. No flooding occurred downstream from American Falls Reservoir. The inundated areas and maximum water-surface elevations are shown in a series of 17 hydrologic atlases. The area covered by the atlases extends from Teton Dam downstream to American Falls Reservoir, a distance of 100 miles. The extent of flooding shown on the maps was obtained by field inspections and aerial photographs made during and immediately after the flood. There may be small isolated areas within the boundaries shown that were not flooded, but the identification of these sites was beyond the scope of the study. The elevation data shown are mean-sea-level elevations of high-water marks identified in the field. This particular map (in the 17-map series) shows conditions in the Rigby quadrangle. (Woodard-USGS)
W77-01405

TETON DAM FLOOD OF JUNE 1976, LEWISVILLE QUADRANGLE, IDAHO,
Geological Survey, Boise, Idaho.
H. A. Ray, and B. B. Bigelow.
Available from Branch of Distribution, USGS, 1200 S. Eads St., Arlington, Va. 22202, price $1.75. Hydrologic Investigations Atlas HA-573, 1976. 1 sheet, 1 map.

Descriptors: *Dam failure, *Floods, *Idaho, *Flood profiles, *Maps, Runoff, Water levels, Elevation, High water mark, Contours, Aerial photography.
Identifiers: *Teton Dam(Idaho), *Snake River, Inundated area.

The failure of the Teton Dam caused extreme flooding along the Teton River, Henrys Fork, and Snake River in southeastern Idaho on June 5-8,

1976. No flooding occurred downstream from American Falls Reservoir. The inundated areas and maximum water-surface elevations are shown in a series of 17 hydrologic atlases. The area covered by the atlases extends from Teton Dam downstream to American Falls Reservoir, a distance of 100 miles. The extent of flooding shown on the maps was obtained by field inspections and aerial photographs made during and immediately after the flood. There may be small isolated areas within the boundaries shown that were not flooded, but the identification of these sites was beyond the scope of the study. The elevation data shown are mean-sea-level elevations of high-water marks identified in the field. This particular map (in the 17-map series) shows conditions in the Lewisville quadrangle. (Woodard-USGS)
W77-01406

TETON DAM FLOOD OF JUNE 1976, WOODVILLE QUADRANGLE, IDAHO,
Geological Survey, Boise, Idaho.
H. F. Matthai, and H. A. Ray.
Available from Branch of Distribution, USGS, 1200 S. Eads St., Arlington, Va. 22202, price $1.75. Hydrologic Investigations Atlas HA-576, 1976. 1 sheet, 1 map.

Descriptors: *Dam failure, *Floods, *Idaho, *Flood profiles, *Maps, Runoff, Water levels, Elevation, High water mark, Contours, Aerial photography.
Identifiers: *Teton Dam(Idaho), *Snake River, Inundated area.

The failure of the Teton Dam caused extreme flooding along the Teton River, Henrys Fork, and Snake River in southeastern Idaho on June 5-8, 1976. No flooding occurred downstream from American Falls Reservoir. The inundated areas and maximum water-surface elevations are shown in a series of 17 hydrologic atlases. The area covered by the atlases extends from Teton Dam downstream to American Falls Reservoir, a distance of 100 miles. The extent of flooding shown on the maps was obtained by field inspections and aerial photographs made during and immediately after the flood. There may be small isolated areas within the boundaries shown that were not flooded, but the identification of these sites was beyond the scope of the study. The elevation data shown are mean-sea-level elevations of high-water marks identified in the field. This particular map (in the 17-map series) shows conditions in the Woodville quadrangle. (Woodard-USGS)
W77-01407

TETON DAM FLOOD OF JUNE 1976, ST. ANTHONY QUADRANGLE, IDAHO,
Geological Survey, Boise, Idaho.
C. A. Thomas, H. A. Ray, and H. F. Matthai.
Available from Branch of Distribution, USGS, 1200 S. Eads St., Arlington, Va. 22202, price $1.75. Hydrologic Investigations Atlas HA-566, 1976. 1 sheet, 1 map.

Descriptors: *Dam failure, *Floods, *Idaho, *Flood profiles, *Maps, Runoff, Waer levels, Elvation, High water mark, Contours, Aerial photography.
Identifiers: *Teton Dam(Idaho), *Snake River, Inundated area.

The failure of the Teton Dam caused extreme flooding along the Teton River, Henrys Fork, and Snake River in southeastern Idaho on June 5-8, 1976. No flooding occurred downstream from American Falls Reservoir. The inundated areas and maximum water-surface elevations are shown in a series of 17 hydrologic atlases. The area covered by the atlases extends from Teton Dam downstream to American Falls Reservoir, a distance of 100 miles. The extent of flooding shown on the maps was obtained by field inspections and aerial photographs made during and immediately after the flood. There may be small isolated areas within the boundaries shown that were not flooded, but the identification of these sites was beyond the scope of the study. The elevation data shown are mean-sea-level elevations of high-water marks identified in the field. This particular map (in the 17-map series) shows conditions in the St. Anthony quadrangle. (Woodard-USGS)
W77-01408

TETON DAM FLOOD OF JUNE 1976, DEER PARKS QUADRANGLE, IDAHO,
Geological Survey, Boise, Idaho.
H. A. Ray, C. M. Bennett, and A. W. Records.
Available from Branch of Distribution, USGS, 1200 S. Eads St., Arlington, Va. 22202, price $1.75. Hydrologic Investigations Atlas HA-571, 1976. 1 sheet, 1 map.

Descriptors: *Dam failure, *Floods, *Idaho, *Flood profiles, *Maps, Runoff, Water levels, Elevation, High water mark, Contours, Aerial photography.
Identifiers: *Teton Dam(Idaho), *Snake River, Inundated area.

The failure of the Teton Dam caused extreme flooding along the Teton River, Henrys Fork, and Snake River in southeastern Idaho on June 5-8, 1976. No flooding occurred downstream from American Falls Reservoir. The inundated areas and maximum water-surface elevations are shown in a series of 17 hydrologic atlases. The area covered by the atlases extends from Teton Dam downstream to American Falls Reservoir, a distance of 100 miles. The extent of flooding shown on the maps was obtained by field inspections and aerial photographs made during and immediately after the flood. There may be small isolated areas within the boundaries shown that were not flooded, but the identification of these sites was beyond the scope of the study. The elevation data shown are mean-sea-level elevations of high-water marks identified in the field. This particular map (in the 17-map series) shows conditions in the Deer Parks quadrangle. (Woodard-USGS)
W77-01409

TETON DAM FLOOD OF JUNE 1976, IDAHO FALLS SOUTH QUADRANGLE, IDAHO,
Geological Survey, Boise, Idaho.
H. A. Ray, and H. F. Matthai.
Available from Branch of Distribution, USGS, 1200 S. Eads St., Arlington, Va. 22202, price $1.75. Hydrologic Investigations Atlas HA-575, 1976. 1 sheet, 1 map.

Descriptors: *Dam failure, *Floods, *Idaho, *Flood profiles, *Maps, Runoff, Water levels, Elevation, High water mark, Contours, Aerial photography.
Identifiers: *Teton Dam(Idaho), *Snake River, Inundated area.

The failure of the Teton Dam caused extreme flooding along the Teton River, Henrys Fork, and Snake River in southeastern Idaho on June 5-8, 1976. No flooding occurred downstream from American Falls Reservoir. The inundated areas and maximum water-surface elevations are shown in a series of 17 hydrologic atlases. The area covered by the atlases extends from Teton Dam downstream to American Falls Reservoir, a distance of 100 miles. The extent of flooding shown on the maps was obtained by field inspections and aerial photographs made during and immediately after the flood. There may be small isolated areas within the boundaries shown that were not flooded, but the identification of these sites was beyond the scope of the study. The elevation data shown are mean-sea-level elevations of high-water marks identified in the field. This particular map (in the 17-map series) shows conditions in the Idaho Falls South quadrangle. (Woodard-USGS)
W77-01410

TETON DAM FLOOD OF JUNE 1976, IDAHO FALLS NORTH QUADRANGLE, IDAHO,
Geological Survey, Boise, Idaho.
H. A. Ray, and H. F. Matthai.
Available from Branch of Distribution, USGS, 1200 S. Eads St., Arlington, Va. 22202, price $1.75. Hydrologic Investigations Atlas HA-574, 1976. 1 sheet, 1 map.

Descriptors: *Dam failure, *Floods, *Idaho, *Flood profile, *Maps, Runoff, Water levels, Elevation, High water mark, Contours, Aerial photography.
Identifiers: *Teton Dam(Idaho), *Snake River, Inundated area.

The failure of the Teton Dam caused extreme flooding along the Teton River, Henrys Fork, and Snake River in southeastern Idaho on June 5-8, 1976. No flooding occurred downstream from American Falls Reservoir. The inundated areas and maximum water-surface elevations are shown in a series of 17 hydrologic atlases. The area covered by the atlases extends from Teton Dam downstream to American Falls Reservoir, a distance of 100 miles. The extent of flooding shown on the maps was obtained by field inspections and aerial photographs made during and immediately after the flood. There may be small isolated areas within the boundaries shown that were not flooded, but the identification of these sites was beyond the scope of the study. The elevation data shown are mean-sea-level elevations of high-water marks identified in the field. This particular map (in the 17-map series) shows conditions in the Idaho Falls North quadrangle. (Woodard-USGS)
W77-01411

SURFACE WATER SUPPLY OF THE UNITED STATES, 1966-70: PART 3. OHIO RIVER BASIN--VOLUME 1. OHIO RIVER BASIN ABOVE KANAWHA RIVER.
Geological Survey, Reston, Va.
Available from Supt. of Documents, GPO, Wash., D.C. 20402, price $5.45. Water-Supply Paper 2107, 1976. 668 p, 1 fig.

Descriptors: *Hydrologic data, *Surface water, *Streamflow, *Lakes, *Ohio River, River basins, Maryland, New York, Ohio, Pennsylvania, West Virginia, Basic data collections, Runoff, Discharge(Water), Gaging stations, Flow measurement, Average flow, Reservoir stages.
Identifiers: *Ohio River basin, Maximum discharges, Minimum discharges.

This is one of 37 reports presenting records of stage and discharge of streams, and of stage and contents of lakes and reservoirs in the United States during the 1966-70 water years; it contains the records for gaging stations and partial-record stations in the Ohio River basin above Kanawha River. This report is one of the second series of water-supply papers to be published on a 5-year basis. The first series covered the 5-year period October 1, 1960, to September 30, 1965. This series covers the period October 1, 1965, to September 30, 1970. The daily table for stream-gaging stations gives the mean discharge for each day and is followed by monthly and yearly summaries of total, average, maximum, and minimum discharges. (Woodard-USGS)
W77-01412

SURFACE WATER SUPPLY OF THE UNITED STATES, 1966-70: PART II. PACIFIC SLOPE BASINS IN CALIFORNIA--VOLUME 4. NORTHERN CENTRAL VALLEY BASINS.
Geological Survey, Reston, Va.
Available from Branch of Distribution, USGS, 1200 S. Eads St., Arlington, Va 22202, price $5.85. Geological Survey Water-Supply Paper 2131, 1976. 747 p, 9 fig.

Descriptors: *Hydrologic data, *Surface waters, *Streamflow, *Lakes, *California, Basic data col-

lections, Runoff, Discharge(Water), Gaging stations, Flow measurement, Flow rates, Average flow, Reservoir, Reservoir stages.
Identifiers: *Pacific slope basins(Calif), Northern Central Valley, Maximum discharges, Minimum discharges, Reservoir content.

This is one of 37 reports presenting records of stage and discharge of streams, and of stage and contents of lakes and reservoirs in the United States during the 1966-70 water years; it contains the records for gaging stations and partial-record stations in the Pacific slope basins in California, Northern Central Valley. The daily table for stream-gaging stations gives the mean discharge for each day and is followed by monthly and yearly summaries of total, average, maximum, and minimum discharges. Data for partial record station are presented in two tables. The first is a table of discharge measurements at low-flow partial-record stations, and the second is a table of annual maximum stage and discharge at crest-stage stations. For most gaging stations on lakes and reservoirs the data comprise a descsription of the station and a monthly summary table of stage and contents. For some reservoirs a table showing daily contents or stage is given. (Woodard-USGS)
W77-01413

LIMNOLOGICAL DATA REPORT FOR THE MAINE DEPARTMENT OF ENVIRONMENTAL PROTECTION--U. S. GEOLOGICAL SURVEY COOPERATIVE LAKE STUDIES PROJECT,
Geological Survey, Augusta, Maine.
For primary bibliographic entry see Field 2H.
W77-01414

GROUND-WATER DATA FOR THE SANTA MARIA VALLEY, CALIFORNIA,
Geological Survey, Menlo Park, Calif.
For primary bibliographic entry see Field 4B.
W77-01415

CHEMICAL AND PHYSICAL CHARACTERISTICS OF WATER IN ESTUARIES OF TEXAS, OCTOBER 1971-SEPTEMBER 1973,
Geological Survey, Austin, Tex.
For primary bibliographic entry see Field 5B.
W77-01416

HYDROLOGIC DATA FOR URBAN STUDIES IN THE HOUSTON, TEXAS METROPOLITAN AREA, 1974,
Geological Survey, Austin, Tex.
C. E. Ranzau, Jr.
Open-file report, June 1976. 228 p, 16 fig, 14 tab, 4 ref.

Descriptors: *Hydrologic data, *Urban hydrology, *Water quality, *Streamflow, *Reservoir storage, Texas, Rainfall-runoff relationships, Urban runoff, Gaging stations, Flow rates, Chemical analysis.
Identifiers: *Houston(Tex).

Basic hydrologic data collected in the Houston urban area for the 1974 water year (October 1973 to September 1974) are presented. Precipitation data are based on 29 recording rain gages in the Houston metropolitan area. Rainfall for the year was unevenly distributed over the area. Individual station totals ranged from 32.8 inches at the Old Richmond Road rain gage to 61.8 inches at the Llano Street rain gage. The 30-year average (1941-70 is 48.19 inches at the Houston Intercontinental Airport rain gage. The only area-wide storm selected for analysis was the storm of January 19. runoff data are based on discharge measurements and stage records at 19 continuous-record stream-gaging stations, 6 partial-record stream-gaging stations, and 2 reservoir-content stations. A tabulation of water-quality data is included for 19 sites. (Woodard-USGS)
W77-01419

SIMULATION OF EVAPOTRANSPIRATION AND DRAINAGE FROM MATURE AND CLEAR-CUT DECIDUOUS FORESTS AND YOUNG PINE PLANTATION,
Forest Service (USDA), Franklin, N.C. Coweeta Hydrologic Lab.
For primary bibliographic entry see Field 2D.
W77-01424

SYSTEM ANALYSIS: SPRINKLER SPACING, (SISTEEMANALISE: SPRINKELAAR-SPASIERING),
South Africa Dept. of Agricultural Technical Services, Pretoria.
For primary bibliographic entry see Field 3F.
W77-01453

COMPILATION OF STATE DATA FOR EIGHT SELECTED TOXIC SUBSTANCES, VOL. III, ANNOTATED BIBLIOGRAPHY OF STATE DATA AND INFORMATION SOURCES,
Mitre Corp., McLean, Va.
For primary bibliographic entry see Field 5A.
W77-01494

8. ENGINEERING WORKS

8A. Structures

SUGARLOAF CREEK PROJECT (AUSTRALIA): FLOOD STUDIES.
Melbourne and Metropolitan Board of Works (Australia). Water Supply Div.
Report No. MMBW-W-0053, December 1975. 7 p., 12 fig., 3 tables, 3 ref., 2 append.

Descriptors: *Design data, *Reservoir design, *Australia, Unit hydrographs, Inflow, Probable maximum precipitation, Rainfall-runoff relationships, Frequency curves, Duration curves, Rainfall intensity, Small watersheds, *Water supply.
Identifiers: *Sugarloaf Creek Reservoir(Vic), *Yarra River(Vic), *Melbourne(Vic).

The Sugarloaf Creek Reservoir is planned to provide additional storage for metropolitan water supply to Melbourne (Victoria, Australia) by pumping water from the Yarra River during periods of excess flow. The Clark-Johnstone synthetic unitgraph procedure is used to derive the inflow hydrograph resulting from an estimated maximum probable precipitation over the reservoir catchment, and intensity-frequency-duration curves for return periods ranging from one to a thousand years are presented. (CSIRO)
W77-01067

CAUGHT IN MID-STREAM: ARMY CORPS OF ENGINEERS,
For primary bibliographic entry see Field 6E.
W77-01086

FEDERAL MANPOWER IN WATER RESOURCE ENGINEERING,
Bureau of Reclamation, Denver Colo.
For primary bibliographic entry see Field 6B.
W77-01342

THOR ACROSS THE LIMPOPO.
Construction in Southern Africa, Vol 20 (6), p 63-39, (1975). 3 fig, 3 tab.

Descriptors: *Water demand, Dam design, Geologic investigations, Barrages, Irrigation, *Water supply, Africa.
Identifiers: *Limpopo River, South Africa, Rhodesia, Thor Dam.

The critical situation with water supplies around Beit Bridge (which is the border post between Rhodesia and the Republic of South Africa) has at last, after many years of discussion, led to a project to dam the Limpopo River. Rhodesia was going to participate, but has now dropped out. The project will, however, carry on and the Thor Dam will now become a reality. The author gives details of the water requirements that led to the decision to construct the dam, as well as full particulars of the expected growth rate, demand on the proposed dam, the geology of the site, and the specifications of the dam. (South Africa)
W77-01369

A MATTER OF HYDRAULICS AT STEENBRAS.
For primary bibliographic entry see Field 8C.
W77-01370

ORANGE RIVER PROJECT, RIVER DIVERSION AT P K LE ROUX DAM,
C. A. Carter.
The Civil Engineer in South Africa, Vol. 16 (9), p 300-301, (1974).

Descriptors: Cofferdams, Probability, Flood damage, Flood control, Africa, Damsites, Dam design, Flood forecasting.
Identifiers: *South Africa, Orange River, P K le Roux Dam, Orange River project.

A description is presented of the design and performance of the river diversion system at the P K le Roux Dam site to hold at bay the waters of the Orange River during the construction of the dam. It was decided to dispense with concrete cofferdams, to construct earth embankments and to operate the Hendrik Verwoerd Dam upstream in such a way as to provide a volume in the reservoir for flood storage. Two floods in one wet season, both topping the 1 in 40 years probability occurring during the one vulnerable flood season of construction are described. (South Africa)
W77-01372

EXPLORING THE DRAKENSBERG.
For primary bibliographic entry see Field 4A.
W77-01373

SOUTH AFRICA'S OWN SNOWY MOUNTAIN SCHEME,
For primary bibliographic entry see Field 8C.
W77-01374

R10 MILLION WATER SCHEME NEARS COMPLETION, IRRIGATING THE ISLANDS OF THE ORANGE.
For primary bibliographic entry see Field 3F.
W77-01375

HARNESSING THE CUNENE'S MIGHT.
For primary bibliographic entry see Field 8C.
W77-01376

THE ORANGE-FISH TUNNEL - THE LONGEST AQUEDUCT IN THE SOUTHERN HEMISPHERE (DIE ORANJE-VISTONNEL - LANGSTE AKWADUK IN SUIDELIKE HALFROND).
The Civil Engineer in South Africa, Vol 17 (6), p 148-150, (1975).

Descriptors: Tunneling, Tunnel linings, Tunnel design, Ventilation, Diversion structures, Interbasin transfers.
Identifiers: South Africa, Verwoerd Dam, *Orange River project, Fish River, Theebus River.

Describes the construction of the 82 km long Orange-Fish tunnel which diverts the waters of the Orange River at Oviston on the Verwoerd Dam to the Theebus River one of the tributaries of the Fish River which flows into the Indian Ocean near

Port Elizabeth. Full details are given of the excavations, ventilation shafts, concreting and problems experienced with water and methane gas. All the important statistics of the construction work are tabulated. (South Africa)
W77-01384

A SANITARY ENGINEER'S VIEWPOINT ON THE DESIGN, INSTALLATION, MAINTENANCE AND COST OF SANITARY DRAINAGE SYSTEMS IN HIGH-RISE BUILDINGS,
G. T. Murray.
Municipal Engineer, Vol 5 (6), p 51-59, (1974).

Descriptors: *Buildings, *Drainage systems, Sewerage, *Design criteria, Plumbing, Legislation, Costs, Maintenance.
Identifiers: South Africa.

The importance of design and its effect on the installation, maintenance and cost of above-ground sanitary drainage in high-rise buildings is emphasied. Comments are confined to modern complex buildings of more than 20 floors. It is intended to provide some useful pointers for cost-conscious developers and those responsible for plumbing design. This paper deals with the present need for the future situation and highlights the desperate need for the updating of plumbing by-laws, the establishment of a standard plumbing code for the country, more intensive specialized education for architectural students, and better technical training for apprentice plumbers. The content is based on the experience of a plumbing contractor. (South Africa)
W77-01388

FACELIFT TO BEAT THE FLOODS.
Construction in Southern Africa, Vol 20(7), p 65, 67, 71, (1975). 3 fig.

Descriptors: *Flood protection, Economics, *Water supply development, *Flood control.
Identifiers: *South Africa, East London, Laing Dam, Buffalo River.

While the Laing Dam has always been the property of East London, it is now proposed that the South African Department of Water Affairs should take it over and spend about R5-million on betterment to improve its stability under flood conditions, as well as augmenting the water supply to the King William's Town-Berlin area. (South Africa)
W77-01477

R26M DAM PLAN FOR THE LOWVELD.
Construction in Southern Africa, Vol 20(9), p 51, 53, 59, (1975). 3 fig, 2 tab.

Descriptors: Irrigation, *Dam construction, *Design criteria, Rockfill dams, Water requirements, Costs, Structural geology, *Water utilization, *Water supply.
Identifiers: *South Africa, Crocodile River, Transvaal, Mozambique.

To improve and regulate the sometimes tricky water supply situation near Nelspruit, the Department of Water Affairs is considering the construction of a new dam, which will have a catchment area in excess of 1 100 km2 and a storage capacity of 167 million m3. Completion should be late in 1982. A description is given of the water requirements of the area, the geology of the site, the proposed works, and an estimate of the cost of the project is given. (South Africa)
W77-01478

8B. Hydraulics

NUMERICAL COMPUTATION OF WELL-MIXED ESTUARINE FLOWS,
Lanchester Polytechnic, Coventry (England). Dept. of Civil Engineering.
For primary bibliographic entry see Field 2L.
W77-01139

STOCHASTIC CHARACTERISTICS OF SEDIMENT MOTIONS,
Singapore Univ. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2J.
W77-01140

HYDRODYNAMICS OF PERCHED MOUNDS,
California State Univ., Fullerton. Dept. of Civil Engineering.
For primary bibliographic entry see Field 4B.
W77-01141

COMPARISON OF CHUTE AND STILLING BASIN PERFORMANCE FOR THREE DIFFERENT DROP BOX INLETS,
Agricultural Research Service, Stillwater, Okla. Water Conservation Structures Lab.
W. O. Ree.
Report No. ARS-5-126, 13 p, July 1976. 19 fig, 3 tab.

Descriptors: *Chutes, *Settling basins, *Hydraulic structures, *Laboratory tests, *Hydraulic jump, *Oklahoma, Scour, Lakes, Flood control, Model studies, Hydraulics.
Identifiers: *Drop box inlets, *Stillwater(Okla), *Boomer Lake(Okla).

A dam was constructed in 1926 to create Boomer Lake at Stillwater, Oklahoma. Presently the lake serves as a cooling pond and a recreational facility. A chute spillway is proposed so that the lake may also serve as a flood control facility for the city. The site conditions and constraints indicated the need for a spillway with a long weir and a chute. The stilling basin was designed for a flow of 16,000 cfs. A model was built to a scale of 1 to 50. Three different drop (entrance box) inlets were tested and compared to determine their influence on the performance of the chute spillway and the stilling basin at the outlet of the chute. The three inlets were steep entrance box, level entrance box, and deep entrance box. Test results indicated that upstream pool levels, wave heights along the chute walls, and scour depths in the downstream channel were alike for the three entrance boxes. An advantage of the steep entrance box was a smaller associated uplift force. (Singh-ISWS)
W77-01151

METHOD FOR LOWERING GROUND WATER,
A. J. D'Amiano.
U.S. Patent No. 3,965,685, 8 p, 14 fig, 8 ref; Official Gazette of the United States Patent Office, Vol 947, No 5, p 1946, June 29, 1976.

Descriptors: *Patents, Groundwater, *Water table, *Water levels, *Wellpoints, *Water wells, Water sources, Dug wells, Aquifers.

In order to eliminate the need to waste expensive sand, to avoid the needless labor associated with packing the sand around the well point tube and the need for a high pressure source of water at the side, a modular well point has been developed comprising an inner well point tube, having perforations at the bottom end and surrounded by a coaxial screen. Between the screen and the inner tube, there is placed particulate matter, such as gravel, and the bottom end is sealed. An annular top plate is used to seal the space around the top end of the inner tube and the screen and to seal in the gravel. The upper end of the inner tube is adapted to be coupled to a vacuum pump which pumps the water in the water table surrounding the well point down through the screen, and through the gravel, into the perforations at the bottom of the inner tube, and thence upward out the center of the tube. The prepacked well point, after installation can be removed and reused, avoiding the need for new gravel. The pre-packed modular well point can be made in predetermined lengths and connected together, modularly, to form a well point of any desired length. (Sinha-OEIS)
W77-01196

GEOTHERMAL ENERGY WELL CASING SEAL,
Sperry Rand Corp., New York, (Assignee).
H. B. Matthews.
U.S. Patent No. 3,967,448, 7 p, 2 fig, 9 ref; Official Gazette of the United States Patent Office, Vol 948, No 1, p 53-54, July 6, 1976.

Descriptors: *Patents, *Geothermal studies, *Heat flow, *Temperature, *Thermal conductivity, *Thermal properties, Energy, Energy transfer, Pumps, Steam turbines, Well casings.
Identifiers: Closed-loop steam generator, *Well casing seals.

A geothermal energy transfer and utilization system makes use of thermal energy stored in hot solute-bearing well water to generate super-heated steam from an injected flow of clean water. The super-heated steam is then used for operating a turbine-driven pump at the well bottom for pumping the hot solute-bearing water at high pressure and in liquid state to the earth's surface, where it is used by transfer of its heat to a closed-loop steam generator-turbine-alternator combination for the beneficial generation of electrical or other power. Residual concentrated solute-bearing water is pumped back into the earth. The clean cooled water regenerated at the surface-located system is returned to the deep well pumping system also for lubrication of a fluid bearing arrangement supporting the turbine-driven pump system. The deep well pump system is supported within the well casing pipe from the earth's surface by the turbine exhaust steam conduit. In view of differential expansion effects on the relative lengths of the casing pipe and the exhaust steam conduit, a flexible seal is provided between the suspended turbine-pump system and the well pipe casing. (Sinha-OEIS)
W77-01205

BREAKWATER CONSTRUCTION,
Raymond International, Inc., Houston, Tex. (Assignee).
T. Plodowski.
U.S. Patent No. 3,969,900, 6 p, 5 fig, 8 ref; Official Gazette of the United States Patent Office, Vol 948, No 3, p 885-886, July 20, 1976.

Descriptors: *Patents, *Breakwaters, *Engineering structures, *Buoyancy, Floating, Ocean waves, Barriers, Shore protection, Coastal structures, Piles(Foundations), Structural members.

Arrangements are provided whereby the sea itself is used, through buoyant action to sustain the major portion of the weight of the breakwater. These arrangements include a main module of substantially neutral buoyancy and having an upstanding wall-like surface for resisting wave action. The module is positioned so that its wall-like surface extends from below the sea surface to above the sea surface to encounter sea waves. The module is formed with front and rear portions displaced from each other in a direction transverse to the plane of the wall-like surface. A number of pile members extend down from the front and rear portions of the module and into the sea bed below to a depth sufficient to attain resistance to lateral movement of the main module. The buoyancy distribution of the module is arranged so that the front portion, that is, the portion upstream of wave action, is of negative (sinking) buoyancy

while rear portion is of positive buoyancy. This imposes a tilting force on the module in a direction counter to the forces produced by wave action. In addition the forwardmost pile-like members are prestressed in compression while the rearward pile members are prestressed in tension. As a result, the wave action of the sea in pressing against the wall-like surface acts in an untilting manner so that the stresses in the piles become relieved and the structure is enabled to withstand high sea forces. (Sinha-OEIS)
W77-01221

FLOATING BREAKWATERS,
Ishikawajima-Harima Heavy Industries Co., Tokyo (Japan). (Assignee).
T. Matsudaira, and Y. Mishina.
U.S. Patent No. 3,969,901, 5 p, 7 fig, 3 ref; Official Gazette of the United States Patent Office, Vol 948, No 3, p 886, July 20, 1976.

Descriptors: *Patents, *Breakwaters, *Engineering structures, *Barriers, *Coastal structures, *Shore protection, Ocean waves, Floating.

The primary object of the invention is to provide an improved floating breakwater which may be held substantially at rest against the waves of expected periods without causing pitching, and which may very effectively reflect and depress or abate the waves of a wide range of wave lengths so that a safe and comparatively calm sea space may be provided behind the breakwater. A number of floating breakwater units are interconnected with each other in side by side relation and anchored to the sea bottom with anchor cables or chains. Each floating breakwater unit comprises a center float, a front and rear barrier joined with connecting members in suitably spaced apart relation or directly joined to the center float so as to define the separated spaces between them. The adjacent floating breakwater units are interconnected with suitable interconnecting means in such a way that they may be moved independently from each other to some extent and may be prevented from colliding against and parting from each other. In like manner, the adjacent buoys are interconnected with a suitable connecting member such as rope, chain or bar so that they may be normally spaced apart from each other by a desired distance. (Sinha-OEIS)
W77-01222

BREAKWATER SYSTEM FOR CREATING ARTIFICIAL SANDBARS,
C. W. Greenleaf.
U.S. Patent No. 3,971,221, 6 p, 6 fig, 4 ref; Official Gazette of the United States Patent Office, Vol 948, No 4, p 1343, July 27, 1976.

Descriptors: *Patents, *Breakwaters, *Barriers, *Waves(Water), Shore protection, Sand bars, Coasts, Suspended solids, Floating, Coastal structures.
Identifiers: Artificial sand bars.

The breakwater comprises a flotation member having a leeward end defining a pivotal axis and a structural member for applying a force to the flotation member causing it to pivot about the axis and urge the leeward end into the body of water. The first or leeward end of the flotation member dips below the surface of the water when waves of moderate strength appear. This tends to slow the flow of water, causing suspended sand to drift to the bottom, forming the beginnings of an artificial sandbar. If the waves become too great, the upwardly urged second or windward end will catch the wave crest, and as the wave passes, urge the leeward end to the surface. The leeward end thus provides minimal resistance to the larger waves, and as a result, the flotation member can 'ride out' the destructive force of such waves. When waves of moderate strength reappear, the leeward end of the flotation member will again impede the water flow, causing more sand to gravitate to the seabed. Ultimately, enough sand will drop to the bottom to form an artificial sandbar. The resulting sandbar will typically have all of the shore protection features of the massive, bulk-fill breakwaters. The sandbar, however, is produced at minimal cost and without the obvious transportation and construction problems. After the artificial sandbar has been constructed, the breakwater can be moved to other locations for creating additional sandbars.
W77-01231

DISCHARGE CHARACTERISTICS OF SPACED SLITS IN POLYETHELENE PIPES UNDER PULSATING PRESSURE CONDITIONS,
Pretoria Univ. (South Africa). Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 3F.
W77-01443

VORTEX VELOCITY PREDICTION WITH EMPHASIS DIRECTED TOWARD VORTEX TUBE SEDIMENT TRAP DESIGN,
Nebraska Univ., Lincoln. Dept. of Agricultural Engineering.
R. J. Edling, B. J. Barfield, and C. T. Haan.
Presented at the 1975 Winter Meeting of the American Society of Agricultural Engineers, December 15-18, 1975. Chicago, Illinois. 25 p, 5 fig, 2 tab, 14 ref.

Descriptors: *Sediments, *Sediment control, *Mathematical models, Model studies, Velocity, Design criteria, Forecasting.
Identifiers: *Vortex velocity(Sediments).

The variation in coefficients relating mean velocity, wall velocity and vortex perimeter velocity indicate the values from the empirical technique, if used, could only be considered as rough estimates. The agreement between the expected pattern of stream function and the predicted pattern and the approximation of upper slot and mainstream measured velocities by the mathematical model encourage further work with the model. Closer agreement between measured and predicted values is desirable, however, the present model gives a first order approximation. It is recommended that changes in the lower boundary conditions for turbulence kinetic energy, dissipation and vorticity be studied. Successful prediction of the point mean velocity and turbulent parameters in complex flows would have many applications. (Skogerboe-Colo St)
W77-01520

8C. Hydraulic Machinery

WET COOLING TOWER WITH PLUME ELIMINATOR,
Westinghouse Electric Corp., Pittsburgh, Pa. (Assignee).
For primary bibliographic entry see Field 5G.
W77-01193

WAVE ENERGY MACHINE,
E. J. Paradiso.
U. S. Patent No. 3,965,679, 5 p, 4 fig, 3 ref; Official Gazette of the United States Patent Office, Vol 947, No 5, p 1944, June 29, 1976.

Descriptors: *Patents, *Energy, *Energy conversion, *Energy dissapation, *Waves(Water), Energy transfer, Coastal structures, Equipment.

A device for utilizing wave energy that is otherwise lost, or spent in eroding shore lines and/or shore facilities has a combined trough-turbine arrangement. An inclined ramp, curved and triangular deflectors, bucket-wheel combinations, and turbine guards combine with a flywheel to provide smooth-flowing power from wave energy. The interrelationships of the various parts reduces turbulence and increases the thrust of an incoming volume of wave energy to rotate a shaft from which power can be derived. (Sinha-OEIS)
W77-01194

GEOTHERMAL ENERGY WELL CASING SEAL,
Sperry Rand Corp., New York, (Assignee).
For primary bibliographic entry see Field 8B.
W77-01205

OCEAN THERMAL GRADIENT POWER PLANT,
E. J. Beck.
U. S. Patent No. 3,967,449, 8 p, 3 fig, 5 ref; Official Gazette of the United States Patent Office, Vol 948, No 1, p 54, July 6, 1976.

Descriptors: *Patents, *Thermal power, *Oceans, *Sea water, Hydraulics, Fluid mechanics, Hydraulic systems, Temperature, Energy, Energy transfer, Thermal powerplants.
Identifiers: *Thermal gradient.

An ocean thermal gradient power plant utilizes the concept of converting the potential and/or kinetic energy developed as a low pressure, high specific volume steam to a hydraulic or kinetic working head in seawater. The plant comprises a hull having a pair of air-evacuated, partially submerged compartments. Each compartment contains a static hydraulic head and is interconnected with the other compartment above the level of the static hydraulic heads. One compartment contains a steam-lift pump which, in addition to the static head, creates a hydraulic working head. The water from the hydraulic working head drives a turbine and then exits the compartment to an intermediate depth. Steam from the steam-lift pump is drawn into the other compartment where it is condensed by a barometric condenser. The water in this compartment exits via a pipe extending from the level of the static hydraulic head to an intermediate depth. A Taylor compressor is located at the orifice of the pipe to remove any collected air from the system. (Sinha-OEIS)
W77-01206

CONNECTING CHANNEL BETWEEN TWO DIFFERENT WATER LEVELS,
V. Bauzil.
U. S. Patent No. 3,967,453, 7 p, 10 fig, 8 ref; Official Gazette of the United States Patent Office, Vol 948, No 1, p 55, July 6, 1976.

Descriptors: *Patents, *Channels, *Water levels, *Flow control, *Engineering structures, Stream flow, Check structures, Weirs, Navigation.
Identifiers: Flexible obstacles.

A connecting channel arrangement between two levels or water planes of different vertical height is described so that a permanent continuous communication can be assured between these two water planes. The connecting channel is obstructed partially by multiple, flexible devices forming an obstacle to the free flow of the water in the channel. The flexible device assure a significant reduction of the flow and of the speed flow of the water which would establish itself otherwise within the free channel, yet permitting a permanent connection between the two levels. The flexibility of the devices permits them to deflect out of the way of the passage of floating objects such as the direct passage of boats or large drifting debris. These flexible devices are distributed over the entire length of the channel to assure a uniform and continuous dissipation of the pressure exerted by the upstream weir to the entry of the channel. The flexible devices can be grouped along transverse lines to form a plurality of spaced weirs along the length of the channel with a small height difference in water level at each weir. The flexible devices are of finger-like shape and extend vertically and/or horizontally across the bed of the channel. (Sinha-OEIS)

W77-01207

A MATTER OF HYDRAULICS AT STEENBRAS.
Construction in Southern Africa, Vol 20 (9), p. 61, 65, (1975).

Descriptors: Pumped storage, Hydroelectric plants, Dam design, Tunnel design, Hydraulic aspects, Africa.
Identifiers: Steenbras Dam, South Africa.

The Steenbras Scheme has been described as the most ambitious hydro-electric scheme in the country. When it is completed in 1979 the Municipality of Cape Town will have on its doorstep a 180-MW supply plant, which should adequately cater for the city's requirements for many years to come. A few details are given regarding the dam sites, the contractors, the tunnels and the pumping and electricity generating equipment. (South Africa)
W77-01370

SOUTH AFRICA'S OWN SNOWY MOUNTAIN SCHEME,
T. P. C. Van Robbroeck, and B. W. Graber.
Construction in Southern Africa, Vol 20 (3), p 51-59, (1975).

Descriptors: *Dam design, Rockfill dams, Peak runoff, Computer models, *Hydroelectric plants, Pumped storage, *Flood control, Irrigation.
Identifiers: Tugela River, Natal, *South Africa, Buffalo River(So Africa), Kotongweni-Ntulwana project, Kotongweni Dam, Ntulwana Dam, Mvumase Dam.

The authors propose a hydro-electric scheme on the Tugela River comprising a series of dams and power stations which would be bigger than Australia's Snowy Mountain Scheme and would have many side benefits including flood control, irrigation and water supply. Various dam sites are described and the design of dams suitable for the various sites are discussed. The proposed dams and hydro-electric power stations on the Tugela River would be built to supply cheap peaking power to the inter-connected system network of the South African Electricity Supply Commission and will be supporting a total installed capacity of 5200 MW, comprising 3700 MW of conventional hydro-plant and 1500MW pumped storage plant. (South Africa)
W77-01374

HARNESSING THE CUNENE'S MIGHT.
Construction in Southern Africa, Vol 20 (4), p 12-15, (1975). 2 fig.

Descriptors: *Hydroelectric power, *Water supply, Dam design, Tunnel design, Canals, Hydraulic aspects, Africa.
Identifiers: *South Africa, Angola, Ovambo, Ruacana Falls, Cunene River, South West Africa, Gove dam, Calueque dam.

Despite political uncertainties, work on the combined South African/Angolan Cunene River scheme is progressing as planned. The present estimate of total cost is put at R200-million, most of which will be provided by South Africa. A major constituent of the scheme, the Ruacana Falls hydro-electric facility, while somewhat smaller than its sister projects at Caborra Bassa and Kariba, is nonetheless unique in many ways. Prime mover in the scheme has been S.W.A.'s urgent need for power at present running at about 80 MW and expected to increase four-fold over the next three years. The scheme is divided into three 80 MW phases. A description is given of the Gove dam, the Olushandja dam, the Calueque dam and pumping station, the pipelines, canals, pressure tunnel and other civil engineering work involved including huge underground caverns housing the mechanical and electrical equipment. (South Africa)

W77-01376

POWER AND WATER FOR SOUTH WEST AFRICA,
South West Africa Water and Electricity Corp. (Pty) Ltd., Windhoek.
For primary bibliographic entry see Field 3E.
W77-01382

THE KARAKAYA DAM AND HYDRO-ELECTRIC PROJECT IN EASTERN TURKEY,
R. J. Andrews.
The Civil Engineer in South Africa, Vol 17 (6), p 151-153, (1975). 5 fig.

Descriptors: Arch dams, *Hydroelectric power plants, *Hydroelectric power, *Multiple purpose projects, Irrigation, Economics.
Identifiers: *Turkey, *Karakaya Dam, *Euphrates River.

The Karakaya Dam and Hydro-electric project on the Euphrates River, which is one of the world's largest multi-purpose development schemes, is described. The installation of 2800-MW of hydro-electric power is previewed, combined with an irrigation scheme which will water 700,000 ha arable lands. The Karakaya Dam and Hydro-electric project (contributing 1800-MW) forms an integral part of this scheme and is located downstream of the 1240-MW Keban Project currently in the final stages of completion. An outline is presented, the river system, the geology, the gravity arch dam and powerplant, the spillway, the outline of structural analysis and the economics of the multipurpose development scheme. (South Africa)
W77-01465

THE TUGELA-VAAL STATE PROJECT, (DIE TUGELA-VAAL STAATSWATERPROJEK),
Department of Water Affairs, Pretoria (South Africa).
For primary bibliographic entry see Field 4A.
W77-01490

8D. Soil Mechanics

DAMMING THE CROCODILE.
For primary bibliographic entry see Field 6D.
W77-01472

CHANGE IN BIG DAM PLAN.
Construction in Southern Africa, Vol 20(4), p 85, 89 (1975). 1 fig, 2 tab.

Descriptors: Water supply, *Dam design, Costs, *Rockfill dams, *Planning, Dams, Dam construction.
Identifiers: *Hazelmere Dam, Mdloti River, *South Africa, Natal.

Originally conceived in 1970 for the purpose of supplying the increased urban and industrial water demand in the North Coast area, the plan for the construction on the Hazelmere Dam on the Mdloti River has been substantially revised. Investigations into all aspects of the plan carried out since the publication on the 1971 White Paper have resulted in a large increase in capacity, a change in the type of dam construction, and a steep estimated price increase from R5 million to R12,5 million. (South Africa)
W77-01476

8E. Rock Mechanics and Geology

REDUCTION OF POROSITY BY PRESSURE SOLUTION: EXPERIMENTAL VERIFICATION,
Stanford Univ., Calif. Dept. of Geophysics.
For primary bibliographic entry see Field 2F.

W77-01332

83 KILOMETRES OF RISKS AND UNKNOWNS.
For primary bibliographic entry see Field 8H.
W77-01469

FLOODS, A FISSURE AND A PERFECT HOLING.
South African Tunnelling, Suppl. to Construction in S.A. and Coal, Gold and Base Minerals of S.A., Nov. 1975, p 4-15. 1 fig, 1 tab.

Descriptors: *Outfall sewers, *Tunnel design, *Tunnel construction, Floods.
Identifiers: South Africa, Johannesburg.

The main outfall sewer to Klipspruit and to adjacent purification works at Goudkoppies, presently under construction by the Johannesburg City Council, is a completely new outfall designed to augment, and in parts to replace, the existing system. The completed R3,55 million first phase of the project is described. Despite problems caused by flooding and the intersection of a fault fissure, tunnel excavation for the first phase was successfully completed in April 1973 when a near perfect 'holing' of the tunnels was achieved. A project report is given on the first section of the Klipspruit outfall sewer. (South Africa)
W77-01470

RESEARCH WITH A PRACTICAL BIAS.
South African Tunnelling, Supplement to Construction in S.A. and Coal, Gold and Base Minerals of S.A., Nov. 1975. p 28-32. 2 fig, 1 tab.

Descriptors: *Tunnelling, Rocks, Engineering works, *Tunnel design, *Rock mechanics, Technology, *Mining engineering.
Identifiers: *South Africa, Technical assistance(Industries).

Over the last twenty years the Geomechanics Division of the South African Council for Scientific and Industrial Research (CSIR) has built up an enviable reputation for its research work in the fields of rock mechanics and, more recently, tunnelling. This research effort has been directed towards practical needs and the Division is frequently called upon to give specialist advice on tunnel projects. A review is given of the history of the Geomechanics Division of the CSIR, their present status and how it serves industry in Southern Africa. (South Africa)
W77-01471

MONITORING THE BEHAVIOUR OF ROCK TUNNELS DURING CONSTRUCTION,
For primary bibliographic entry see Field 8G.
W77-01475

8F. Concrete

KERBS AND CHANNELS,
National Physical Research Lab. Pretoria (South Africa).
A. J. Jobson.
Municipal Engineer, Vol 5 (4), p 32-51, (1974). 3 fig, 1 tab.

Descriptors: *Stormwater, *Urban drainage, *Channels, Construction, *Construction costs.
Identifiers: South Africa, *Kerbs.

An informational guide is presented on the functions, types, specifications, methods of construction and construction costs of kerbs and channels used along the edges and central medians of our roads and streets in South Africa. The three basic categories of barrier kerbing, mountable kerbing and flush kerbing are described, together with safety developments such as redirective kerbs,

reflective kerbs, and concrete median barriers. Information is included on kerbside stormwater inlets as an integral part of kerbing and channeling, and on the recent introduction of extruded concrete kerb and channel construction by slipform paver. Based on well-established methods of construction an indication is given of the labour, plant and materials used, the rates of production achieved and construction costs for township streets. (South Africa)
W77-01389

8G. Materials

METHOD FOR PREVENTING SCALE IN SALINE WATER DESALTING APPARATUS AND SALINE WATER RECLAMATION APPARATUS FOR CARRYING OUT SAID METHOD,
Ishikawajima-Harima Engineering Review, Tokyo (Japan). (Assignee).
For primary bibliographic entry see Field 3A.
W77-01215

MONITORING THE BEHAVIOUR OF ROCK TUNNELS DURING CONSTRUCTION,
Z. T. Bieniawski, and R. K. Maschek.
The Civil Engineer in South Africa, Vol 17(10), p 255-264, (1975). 10 fig, 1 tab, 16 ref.

Descriptors: *Tunnel design, Tunnel construction, *Monitoring, Instrumentation, *Measurement.
Identifiers: South Africa.

Presents practical information for both tunnel designers and constructors on the applications and advantages of in situ measurements of ground displacements during construction of tunnels built in rock. The purpose and meaning of such measurements is outlined and the recommended instrumentation described. Practical information is given for the selection, installation, operation and protection of the monitoring equipment. Results are presented of a one-year long tunnel monitoring program involving sixteen measuring stations in a major railway tunnel. These results are interpreted by taking into account other relevant data recorded during construction, such as rock mass classification, rate of face advance and the amount of support used. The monitoring of tunnel behaviour, by allowing a better assessment of rock mass conditions, tunnel stability and the effectiveness of support measures, results in considerable economic advantages to the owner, better design for the engineer and more efficient construction for the contractor. (South Africa)
W77-01475

JOINT SEALING PROBLEMS IN WATER RETAINING STRUCTURES IN JOHANNESBURG,
Johannesburg City Engineer's Dept. (South Africa).
J. E. Kendall, and D. W. Osborn.
The Civil Engineer in South Africa, Vol 17(6), p 135-142, (1975). 11 fig, 3 tab, 5 ref.

Descriptors: Sealants, *Construction joints, Reservoir design, *Reservoir leakage, Reservoir construction, Design criteria, Bacteria, Africa, *Synthetic rubber.
Identifiers: South Africa, Neoprene seal, Polysulphide synthetic rubber, Johannesburg.

The importance of joints in water retaining structures and methods and materials used to seal joints against leakage are described. The failure of jointing at Dunkeld reservoir, its temporary and subsequent permanent repair with a 'bandage' joint seal of polysulphide synthetic rubber compound is fully detailed. The unexpected bacterial attack and degradation of the polysulphide is described and a detailed account of laboratory investigations into the nature of this failure follows. If the long term performance of a Neoprene bandage seal confirms the initial success of this material in Randjeslaagte and Yeoville reservoirs it is suggested that the bandage seal could well eliminate the need for costly waterbars in water retaining structures and attendant construction difficulties. (South Africa)
W77-01479

SEWER LINING,
Council for Scientific and Industrial Research, Pretoria (South Africa).
P. R. Crabtree.
Municipal Engineer, Vol 5 (5), p 13-17, (1974). 9 ref.

Descriptors: *Deterioration, Sewerage, *Linings, *Plastic pipes, *Plastics, Maintenance, Maintenance costs, Monitoring, *Sewers.
Identifiers: South Africa, Television monitoring.

A new technique is described for the renewal of deteriorated sewers namely, a plastic sleeve relining technique whereby high-density polyethylene liners are pulled into existing sewers to restore watertightness and integrity. The process of insert-renewal begins by cleaning and TV inspection of the old sewer. Advantages of and problems with the linings are described. Sewerage engineers are asked to consider the insertion-renewal technique as an alternative to re-excavation, particularly where serious disruption in heavily built-up areas may result from the latter operation. (South Africa)
W77-01491

8H. Rapid Excavation

THE ORANGE-FISH TUNNEL - THE LONGEST AQUEDUCT IN THE SOUTHERN HEMISPHERE (DIE ORANJE-VISTONNEL - LANGSTE AKWADUK IN SUIDELIKE HALFROND).
For primary bibliographic entry see Field 8A.
W77-01384

83 KILOMETRES OF RISKS AND UNKNOWNS.
South African Tunneling, Suppl. to Construction in S.A. and Coal, Gold and Base Minerals of S.A., June 1975, p 6-19. 1 fig.

Descriptors: *Tunneling, *Tunnel design, Ventilation, *Diversion structures, *Inter-basin transfers, Water utilization, Construction.
Identifiers: *South Africa, Verwoerd Dam, *Orange River Project, Theebus River, Fish River.

A special report on the Orange-Fish tunnel is presented. The tunnel is the longest continuous tunnel in the world and one of the most ambitious engineering projects ever undertaken in South Africa. The 82,4 km tunnel will divert water from the Orange River to the Eastern Cape Province where it will be used for irrigation, industrial and urban use. This comprehensive report, after an historic review gives full details of site investigations, preliminary works, design and construction, construction problems, the intake tower and the underground control works. (South Africa)
W77-01469

9. MANPOWER, GRANTS AND FACILITIES

9A. Education (Extramural)

EDUCATION AND TRANING IN WATER RESOURCES PLANNING,
Polytechnic Inst. of New York, Brooklyn.
For primary bibliographic entry see Field 6B.
W77-01344

9B. Education (In-House)

FEDERAL MANPOWER IN WATER RESOURCE ENGINEERING,
Bureau of Reclamation, Denver Colo.
For primary bibliographic entry see Field 6B.
W77-01342

10. SCIENTIFIC AND TECHNICAL INFORMATION

10B. Reference and Retrieval

INFORMATION DISSEMINATION IN THE WATER RESOURCES FIELD,
Missouri Water Resources Research Center, Columbia.
For primary bibliographic entry see Field 10D.
W77-01191

10C. Secondary Publication And Distribution

INFORMATION DISSEMINATION IN THE WATER RESOURCES FIELD,
Missouri Water Resources Research Center, Columbia.
For primary bibliographic entry see Field 10D.
W77-01191

COAL AND THE ENVIRONMENT, ABSTRACT SERIES, MINE DRAINAGE BIBLIOGRAPHY, 1910-1976.
Bituminous Coal Research, Inc., Monroeville, Pa.
For primary bibliographic entry see Field 5G.
W77-01192

WILDLIFE AND OIL SHALE, A PROBLEM ANALYSIS AND RESEARCH PROGRAM. VOLUME II, APPENDIX.
Thorne Ecological Inst., Boulder, Colo.
For primary bibliographic entry see Field 5C.
W77-01236

ANNOTATED BIBLIOGRAPHY OF THE LAKES, PONDS, AND RESERVOIRS OF NEW YORK STATE THROUGH 1974 (EXCLUSIVE OF LAKES ERIE AND ONTARIO),
Geological Survey, Albany, N.Y.
For primary bibliographic entry see Field 2H.
W77-01418

COMPILATION OF STATE DATA FOR EIGHT SELECTED TOXIC SUBSTANCES, VOL. III, ANNOTATED BIBLIOGRAPHY OF STATE DATA AND INFORMATION SOURCES,
Mitre Corp., McLean, Va.
For primary bibliographic entry see Field 5A.
W77-01494

10D. Specialized Information Center Services

INFORMATION DISSEMINATION IN THE WATER RESOURCES FIELD,
Missouri Water Resources Research Center, Columbia.
Stanley E. Manahan.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-260 486. Price codes: A03 in paper copy, A01 in microfiche. Partial Completion Report, June 28, 1976. 43 p, 1 fig, 2 tab. OWRT X-145-MO(NO4269)(1).

Descriptors: *Information retrieval, *Information exchange, Water resources, Indexing, Documentation, Bibliographies, Data collections.
Identifiers: *Information dissemination, *Computer searches, Abstracting services.

The process of information dissemination in the field of water resources has been examined from the viewpoint of the user-researcher. It is concluded that no other aspect of water resources research is more important than information dissemination, particularly from researcher to user. By examining computer searches retrieved from the information base of the Water Resources Scientific Information Center (WRSIC) system it was ascertained that the WRSIC system is a very useful medium for information transfer; however, it is not being used to its full potential largely because of lack of promotional visibility. The present status of information dissemination in the water resources field is evaluated and recommendations are made for an expanded system involving state directors in an integrated system of information dissemination. Through reorganization and some reordering of priorities, such a system can be implemented without substantially greater expense.
W77-01191

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ABSTRACT SOURCES

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A. CENTERS OF COMPETENCE		
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C. OTHER		
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